LX-86

User's Guide

EPSON

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LX-86

User's Guide

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Introduction

The Epson LX-86 printer combines low price with the high quality and advanced features formerly available only on more expensive printers.

LX-86 Features

In addition to the high performance and reliability you have come to expect from an Epson printer, the LX-86 offers:

- Draft mode for quick printing of ordinary work
- Near Letter Quality mode for top quality printing
- Control panel selection of draft or NLQ print modes
- A variety of print styles, including Roman and italic, six widths, and two kinds of bold printing
- User-definable characters so you can create and print your own symbols or characters
- High-resolution graphics for charts, diagrams, and illustrations
- Character/graphic set which is compatible with IBM Personal Computer
- Eleven international character sets
- Easy paper loading
- Ribbon cassette for quick and clean ribbon changing

Using This Guide

This guide contains all the information you need to use the LX-86. The more technical information is in the appendices. The main body of the guide is concerned mainly with a detailed explanation of how to use the commands to their best effect. If you have problems, or simply wish to have an in-depth description of a particular function, refer to the index.

As a preview of the type of output you can obtain from your LX-86, the following shows just a few of the functions.

* NEAR LETTER QUALITY

NLQ standard ABCDEFGHIJKLMnopqrstuvwxyz
NLQ emphasized ABCDEFGHIJKLMnopqrstuvwxyz

* DRAFT MODE

Pica ABCDEFGHIJKLMnopqrstuvwxyz
Elite ABCDEFGHIJKLMnopqrstuvwxyz
Condensed ABCDEFGHIJKLMnopqrstuvwxyz
Italic ABCDEFGHIJKLMnopqrstuvwxyz
Underlined ABCDEFGHIJKLMnopqrstuvwxyz
Emphasized double-width

Chapter 1
Setting Up Your LX-86 Printer

Setting up your LX-86 printer is a simple matter of attaching two parts, fitting the ribbon cartridge, inserting paper, and connecting the printer to your computer.

This chapter will first show you how to print a test pattern and then lead you into doing more complicated work. Familiarisation should not take more than about twenty minutes. For the moment do not plug in or turn on your printer.

Printer Parts

First, see that you have all the parts you need. In addition to this manual, the printer box should contain the items shown in Figure 1-1.

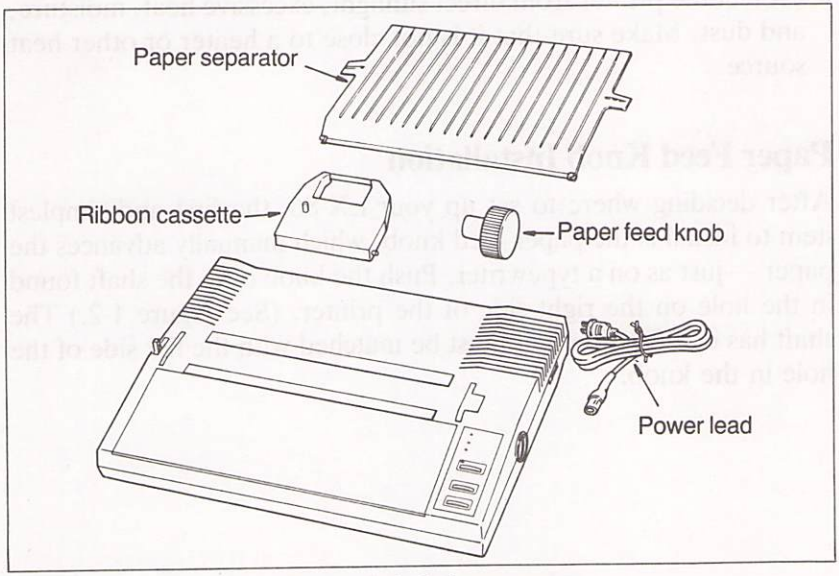


Figure 1-1. Printer parts

In addition to the items in the box, you need a cable and possibly an interface board. The cable connects the printer to your computer, and the interface board is necessary only for those computers that cannot use the LX-86's Centronics parallel interface. Your computer manual or your dealer will tell you which cable you need and whether or not you need a special interface.

Printer Location

Now that you have unpacked your printer, you should choose a suitable location for it. The main requirement, of course, is that the printer be close enough to your computer for the cable to reach. Also remember the following:

- Use an earthed socket, and do not use an adapter plug.
- Be careful when using electrical sockets that are controlled by wall switches. Accidentally turning off a switch can wipe out valuable information in your computer's memory and disrupt your printing.
- Avoid using a socket on the same circuit as any large electrical machines or appliances. These can cause disruptive power fluctuations.
- Keep your printer and computer away from base units for cordless telephones.
- Protect the printer from direct sunlight, excessive heat, moisture, and dust. Make sure that it is not close to a heater or other heat source.

Paper Feed Knob Installation

After deciding where to set up your LX-86, the first and simplest item to install is the paper feed knob, which manually advances the paper —just as on a typewriter. Push the knob onto the shaft found in the hole on the right side of the printer. (See Figure 1-2.) The shaft has one flat side that must be matched with the flat side of the hole in the knob.

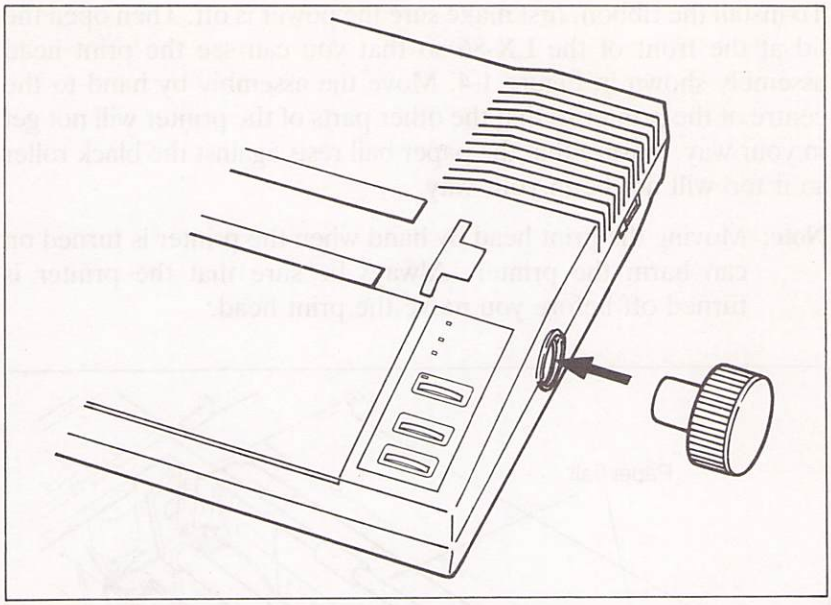


Figure 1-2. Paper feed knob installation

Ribbon Installation

The LX-86 printer uses a continuous-loop, inked fabric ribbon, which is enclosed in a cassette making ribbon installation and replacement a clean and easy job. The parts of this cassette are labelled in Figure 1-3.

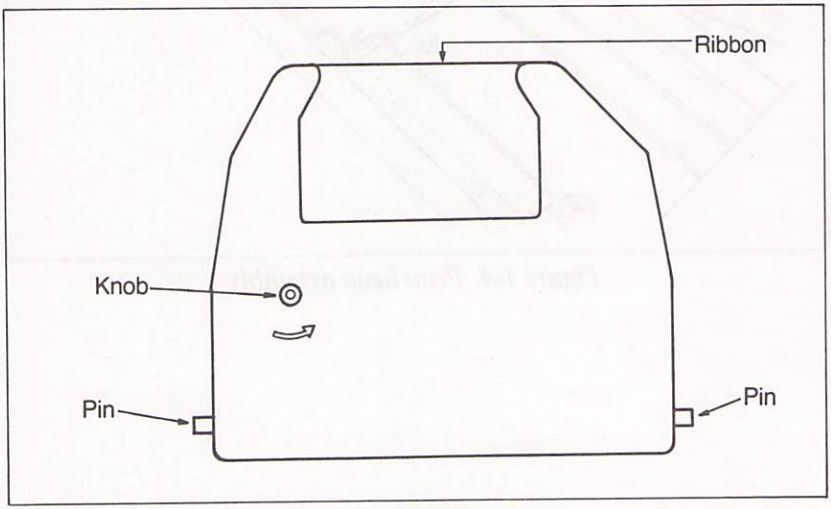


Figure 1-3. Ribbon cassette

To install the ribbon, first make sure the power is off. Then open the lid at the front of the LX-86 so that you can see the print head assembly shown in Figure 1-4. Move the assembly by hand to the centre of the printer so that the other parts of the printer will not get in your way. Ensure that the paper bail rests against the black roller so it too will not be in your way.

Note: Moving the print head by hand when the printer is turned on can harm the printer. Always be sure that the printer is turned off before you move the print head.

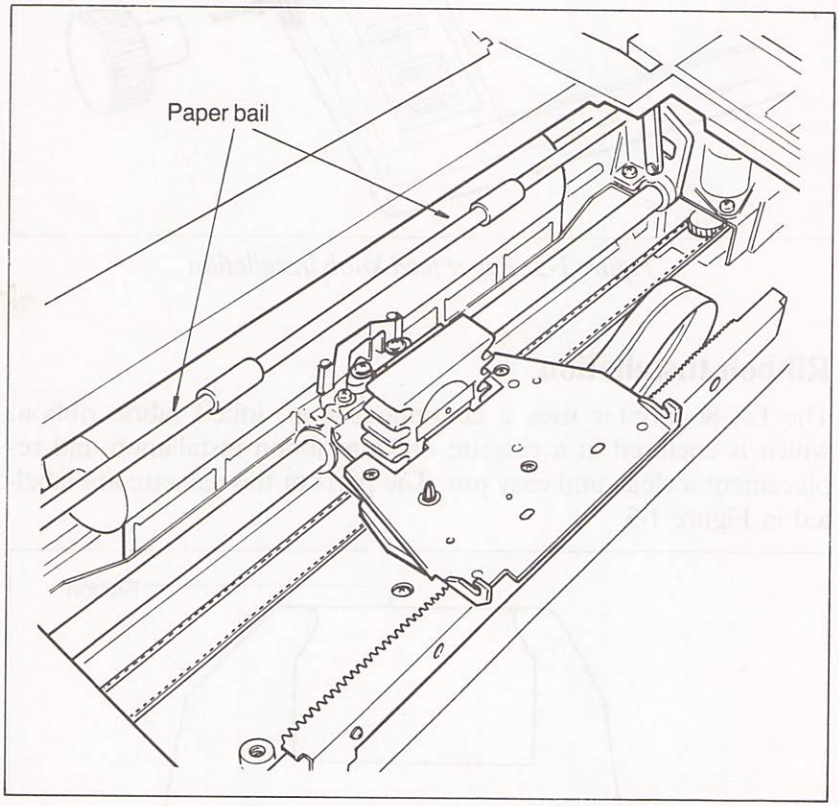


Figure 1-4. Print head assembly

Hold the ribbon cassette so that the small knob is on top and the exposed section of ribbon is away from you. Insert the cassette in its holder by first sliding the pins at the back of the ribbon cassette under the small hooks on the holder. (See Figure 1-5.) Then lower the front of the cassette so that the exposed section of ribbon can fit between the print head nose and the silver ribbon guide. Push down until the cassette fits firmly in place.

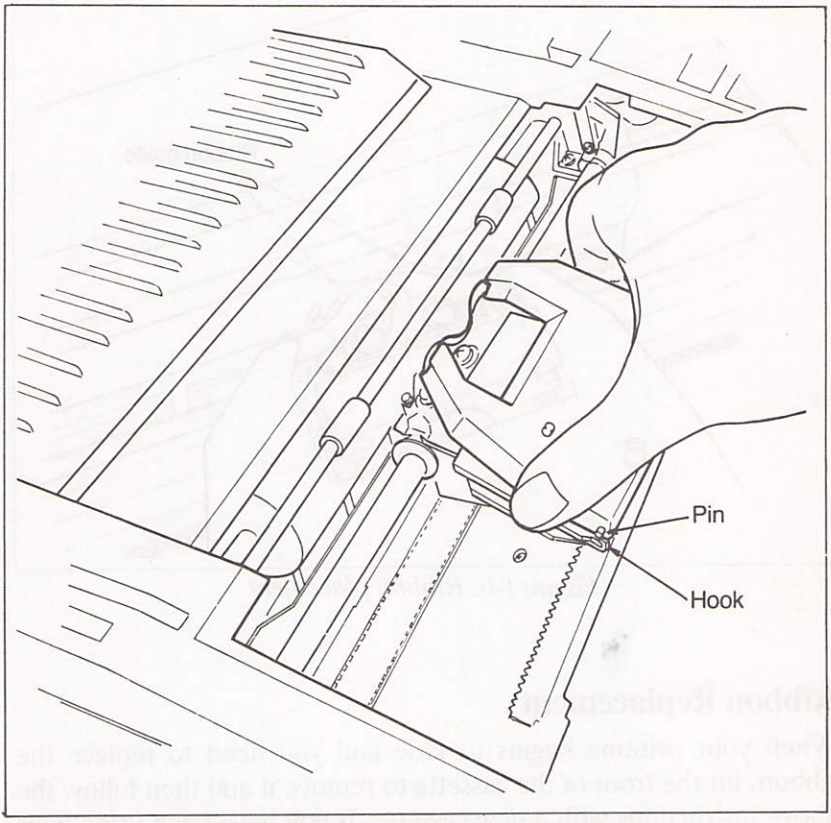


Figure 1-5. Ribbon cassette installation

Now turn the knob on the cassette in the direction of the arrow to take up the ribbon slack. As you turn the knob, see that the ribbon runs correctly between the print head nose and the silver ribbon guide (Figure 1-6). If it doesn't, guide it with a pen or a pencil.

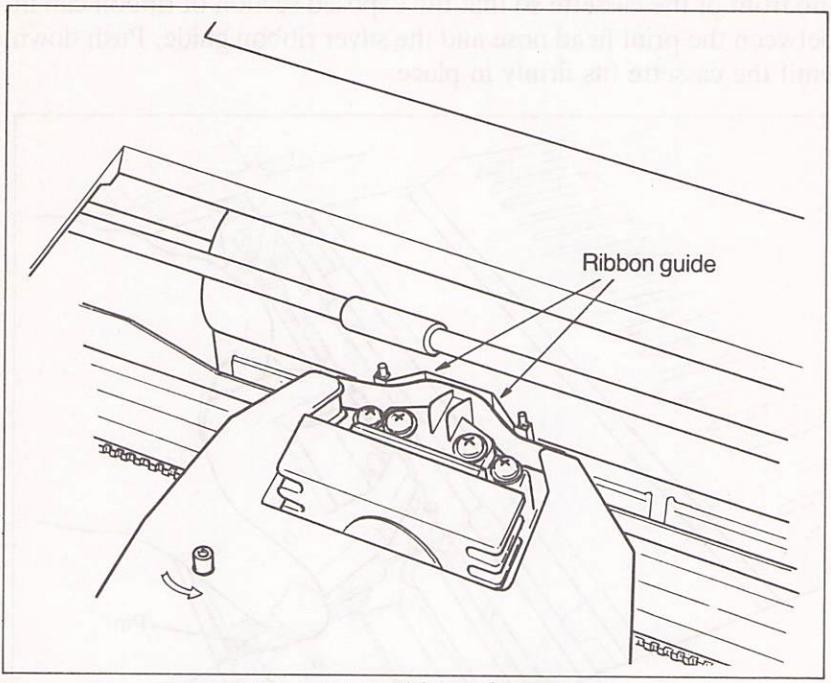


Figure 1-6. Ribbon placement

Ribbon Replacement

When your printing begins to fade and you need to replace the ribbon, lift the front of the cassette to remove it and then follow the above instructions with a new cassette. If you have been using your printer just before you change cassettes, be aware that the print head becomes hot during use. Be careful not to touch it. Also remember never to move the print head by hand when the printer is turned on.

Paper Loading

Now put a sheet of paper in your LX-86 so that you can test it. Figure 1-7 shows the names of the parts that you need to know.

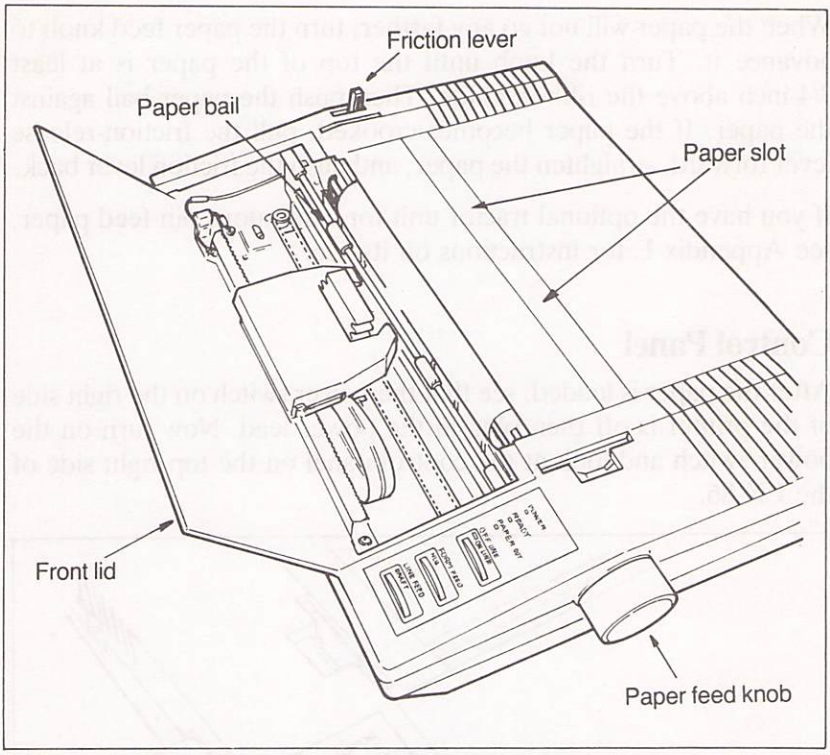


Figure 1-7. LX-86 ready for paper loading

See that the printer is turned off, open the front lid, and push the friction lever back and the paper bail forward. Then move the print head by hand to the centre of the printer and feed the paper into the paper slot in the top of the printer.

When the paper will not go any farther, turn the paper feed knob to advance it. Turn the knob until the top of the paper is at least 3/4-inch above the ribbon guide. Then push the paper bail against the paper. If the paper becomes crooked, pull the friction-release lever forward, straighten the paper, and push the friction lever back.

If you have the optional tractor unit for continuous pin-feed paper, see Appendix E for instructions on its use.

Control Panel

After the paper is loaded, see that the power switch on the right side of the printer is off then plug in the power lead. Now turn on the power switch and look at the control panel on the top right side of the LX-86.

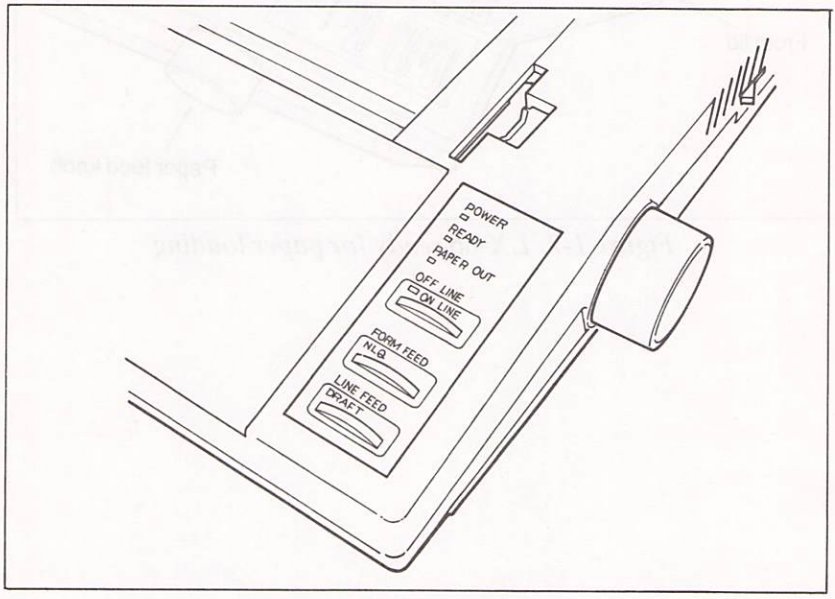


Figure 1-8. Control panel

There are four indicator lights and three buttons on the control panel. Their primary functions are described below:

Lights

- The POWER light glows green when the power is on.
- The READY light glows green when the printer is ready to accept data. This light also flickers somewhat during printing.
- The PAPER OUT light glows red to indicate that the printer is out of paper or the paper is loaded incorrectly.
- The ON LINE light glows green when the printer can receive data.

Buttons

- OFF LINE/ON LINE
  This button switches the printer between on-line and off-line status. When the printer is on-line, the ON LINE light glows and the printer is ready to accept data.

The following two buttons each have two different functions, depending on whether the printer is off-line or on-line.

- FORM FEED/NLQ
  When the printer is off-line (the ON LINE light is not glowing), this button advances the paper to the top of the next page.

  When the printer is on-line, (the ON LINE light is glowing) pressing this button places the printer in NLQ mode so that your printing assumes a sharper, more professional appearance. The printer beeps twice when this mode is entered.

- LINE FEED/DRAFT
  When the printer is off-line, this button advances the paper one line at a time.

  When the printer is on-line, pressing this button places the printer in draft mode, used for fast printing jobs. The printer beeps once when this mode is entered.

The control panel buttons can also be used to turn on several printing functions using a feature called SelecType, which is described in Chapter 2. In addition, you will find another use for the LINE FEED and FORM FEED buttons in the next section.

Test Pattern

The LX-86 can print a test pattern even when not yet connected to a computer. Ensure that the printer has paper in it and that the power switch is off. Hold down the LINE FEED button on the control panel while you turn the printer on with the power switch. The LX-86 will begin printing all the letters, numbers, and other characters that are stored in its ROM for the draft mode. When the printing starts, you can release the LINE FEED button; the printing will continue until you turn the printer off or until the print head gets near the end of the page. To see the same test in the NLQ mode, turn the printer on while holding down the FORM FEED button.

Partial results of both tests are shown in Figure 1-9.

<Draft>

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWX
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXY
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
```

<NLQ>

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWX
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXY
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
```

Figure 1-9. Test patterns

Connecting the LX-86 to Your Computer

Now that the test pattern has shown that your printer is working well, it is time to connect it to your computer. It is best to have both printer and computer turned off when you do this.

Remember that each computer system has its own way of communicating with a printer. If your computer expects to communicate through a Centronics parallel interface, all you need is a cable. If your computer requires any other kind of interface, you will also need an interface board.

If you do not know what a Centronics parallel interface is, your computer manual or your dealer will tell you what you need. Then, once you have plugged your printer cable into your printer and computer, you will probably never think about interfaces again. (If you do want the technical specifications, however, you can find them in Appendix I.)

The first three steps in connecting your printer and computer are shown in Figure 1-10. Plug one end of your printer cable into the cable connector of your LX-86 printer. The D-shape ensures that there is only one way it will fit the connector. Now secure the plug to the printer with the wire clips on each side of the connector. If your cable has an earthing wire, attach it to the earthing screw below the connector.

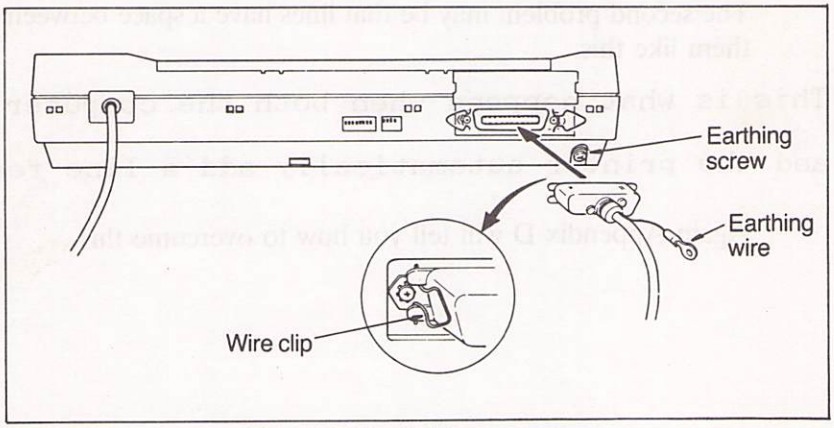


Figure 1-10. Cable connection

Next connect the other end of the printer cable to the computer. On most computers you can easily find the correct connector for the printer cable, but if you are not sure, consult the computer manual or your dealer.

First Printing Exercise

Your next step depends upon what kind of printing you plan to do. If you have a word processing or other commercial software program, load the program into the computer, follow its printing instructions, and the LX-86 will print. If you plan to use the LX-86 for printing program listings, load a program and use the computer system's listing command (LLIST for Microsoft BASIC, for example).

Note: The printing may not be correct. One common problem is that all the lines of your text are printed on top of each other, like this:

```
This is what happens when both the computer
and the printer automatically add a line feed.
```

Do not worry, there is nothing wrong with the printer. All you have to do is change the setting of a small switch in the back of your printer. See the section on automatic line feeds in Appendix D.

The second problem may be that lines have a space between them like this:

```
This is what happens when both the computer

and the printer automatically add a line feed.
```

Again Appendix D will tell you how to overcome this.

Chapter 2
SelecType

This chapter shows how Epson's SelecType feature enables you to use the most-used print modes with a few finger-presses on the control panel buttons of the LX-86.

SelecType Operation

Using SelecType is easy. You turn on SelecType and select a type-style, then turn off SelecType and print.

Before turning on SelecType you should select NLQ or draft using the LINE FEED or FORM FEED button.

Turning SelecType On

1. Make sure that the printer is on and that the POWER, READY, and ON LINE lights are all on.
2. Press both the OFF LINE and FORM FEED buttons at the same time, as illustrated in Figure 2-1. Hold them down for at least a second, then release them.

Note: If the printer beeps twice before you release the buttons, you have pressed FORM FEED button before the OFF LINE button instead of at the same time and the printer is in the NLQ mode. Press the OFF LINE button to put the printer back on line and press the DRAFT button if you do not want NLQ. Then press both the OFF LINE and FORM FEED buttons to turn on SelecType.

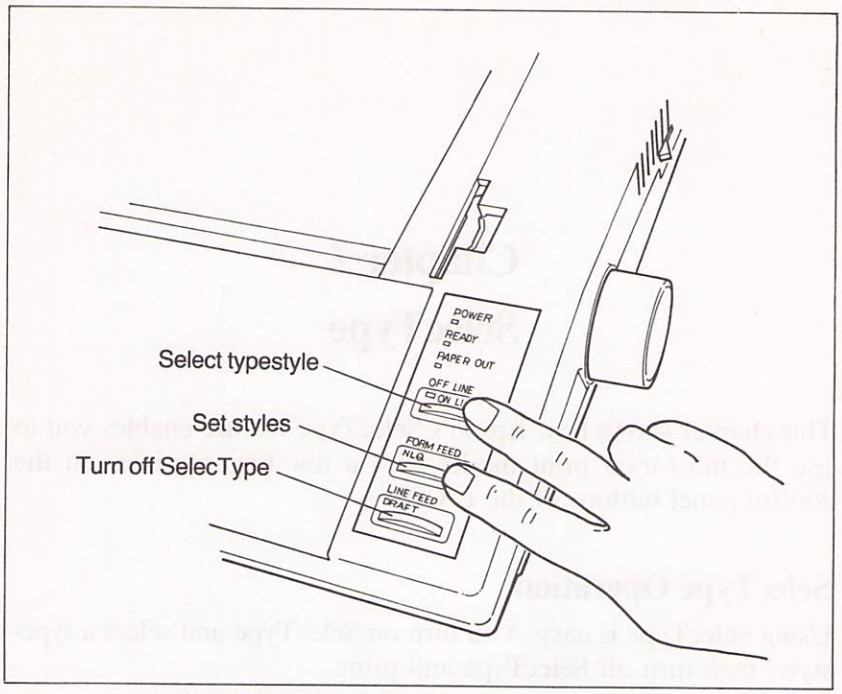


Figure 2-1. SelecType setting and functions

When you release the OFF LINE and FORM FEED buttons, the printer signals in three ways that SelecType is on.

- The printer beeps.
- The READY light turns off.
- The ON LINE light begins flashing.

Selecting typestyles

In SelecType, each button has a function:

- OFF LINE selects typestyles.
- FORM FEED sets the styles.
- LINE FEED turns SelecType off.

After turning on SelecType, follow these three steps to select a typestyle:

1. Find the typestyle you want in Table 2-1.

Table 2-1. SelecType modes

Mode	Typestyle	
	Draft	NLQ
0	Pica	Pica
1	Emphasized	Emphasized
2	Double-strike	—
3	Condensed	—
4	Elite	—

2. Press the OFF LINE button the number of times indicated in the mode column. Be sure that the printer beeps each time you press the OFF LINE button.
3. Press the FORM FEED button to set the typestyle.
4. Press the LINE FEED button to turn SelecType off. The control panel returns to its normal functions, but the printer is off-line.
5. Press the OFF LINE button and you are ready to print.

SelecType exercise

You don't need to know anything about programming for this exercise because it is merely for practice. If you would rather not use BASIC, use your word processing or business program to create a short file or document of the type you will usually print.

If you do want to use BASIC for this exercise, simply turn on your computer and printer and load BASIC. Then type the short program listed below. Only the words inside the quotation marks are printed. You can print anything you want there. (If your version of BASIC does not use LPRINT, consult your BASIC manual.)

```
10 LPRINT "This is an example"
20 LPRINT "of LX printing."
```

Now, run the program by typing **RUN** and pressing **RETURN**, or print your file or document by following the printing instructions of your software. The printer will print your example in standard single-strike draft printing as shown below.

```
This is an example
of LX printing.
```

Now that you have created a sample, follow these steps to print it in double-strike mode.

1. See that both the ON LINE and READY lights are on.
2. Press the OFF LINE and FORM FEED buttons at the same time, then release them. You hear a beep to signal that SelecType is on.
3. As shown in Table 2-1, the code for double-strike is two. Therefore, press the OFF LINE button twice. (Remember to make sure you hear a beep each time you press the OFF LINE button when you are in SelecType mode.)
4. Now that you have selected the double-strike mode, push the FORM FEED button once to set it.
5. Push the LINE FEED button once to return the panel to its standard operation.

Now you have set the printer to print in double-strike mode. Print your sample once more. It should appear in double-strike mode just as you see it below:

```
This is an example
of LX printing.
```

Turn off your printer to cancel the double-strike setting, and–if you wish–try this exercise with other modes.

Note: Some applications programs are designed to control all typestyle functions. These programs cancel all previous typestyle settings by sending a signal (INIT) before printing. Because this signal cancels SelecType settings, you will have to use the program's print options function instead of SelecType to select your typestyles. Therefore, if SelecType does not work with a particular applications program, consult its manual on how to select typestyles.

Mode Combination

Many SelecType modes can be combined for interesting typestyles – double-strike and elite, for example. If you want to see this combination, turn your printer off and back on and follow the instructions below:

1. See that the ON LINE and READY lights are on.
2. Press the OFF LINE and FORM FEED buttons at the same time.
3. Press the OFF LINE button twice and then the FORM FEED button once.

Since two is the code for double-strike, you have now set the printer for double-strike.

4. Press the OFF LINE button two more times and then the FORM FEED button once again.
5. Press the LINE FEED button to return the panel to its standard operation.
6. Press the OFF LINE button to put the printer on-line.

Now print your sample document or run your sample program. Your printing should appear in double-strike elite.

```
This is an example
of LX printing.
```

If you get any other results, turn your printer off and back on and then try the steps again.

SelecType Tips

Once you have learned the simple technique for controlling print styles with SelecType, you can use it whenever you wish. You should be aware of a few restrictions, however.

- SelecType is designed to control the printing of an entire file or document, not an individual line or word.
- If you are using the NLQ mode, remember that the following SelecType modes are not available in NLQ: condensed, double-strike, and elite.
- Emphasized cannot combine with condensed or elite.
- If you wish to cancel SelecType functions, see "Cancelling Functions with SelecType" in Appendix F.

Do not worry about harming your printer if you try to combine two modes that the printer cannot mix. Your settings cannot damage the printer. If it receives codes for two modes that it cannot combine, it uses only one of them.

Chapter 3
Elements of Dot Matrix Printing

This chapter is for those who want to go into how the printer works. It is a simple, non-technical explanation of the basics of dot matrix printing which will give you a better understanding of some of the later chapters.

The Print Head

The LX-86 uses a print head with nine pins or wires mounted vertically. These pins make the dots by being pushed out of their resting position. Since this is analogous to shooting with a gun, it is known as making the pin "fire". Each time a pin is fired, it strikes the inked ribbon and presses it against the paper to produce a dot. This dot is about 1/72nd of an inch in diameter. The size varies slightly depending upon the age of the ribbon and the type of paper used. As the head moves horizontally across the page, these pins are fired time after time in different patterns to produce letters, numbers, symbols, or graphics.

For example, to print a pica capital T, the head fires the top pin, moves 1/60th of an inch, fires the top pin again, moves 1/60th of an inch, fires the top seven pins, moves 1/60th of an inch, fires the top pin, moves another 1/60th of an inch, and fires the top pin once more to finish the letter. All this happens in only 1/120th of a second.

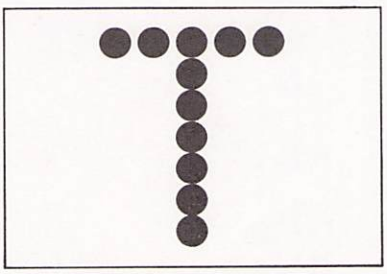


Figure 3-1. A capital T

Bidirectional Printing

Nearly all discussions in this manual describe the action of the LX-86 print head as moving from left to right. However, during its normal operation while printing in the draft mode, the LX-86 prints bidirectionally. This means that the print head first goes from left to right, and instead of coming back to the beginning of the next line, it saves time by printing the next line of characters in reverse from right to left. This is done automatically. You do not know it is happening unless you watch it.

Changing Pitches

In addition to pica, in which there are 10 characters per inch, the LX-86 can also print in other widths, or pitches. It does so by reducing the distance between pin firings. In the elite mode it prints 12 characters per inch and in the condensed mode it prints slightly more than 17 characters per inch. The pattern of the dots is not changed, but the horizontal space between them is reduced.

Figure 3-2 shows enlargements of four sample letters in each of the three pitches. These letters are chosen to show how the LX-86 prints letters that are uppercase (capital letters) and lowercase ("small letters"), wide and narrow, and with and without descenders (i.e., the bottom part of a letter such as y or g which descends below the base-line of most characters).

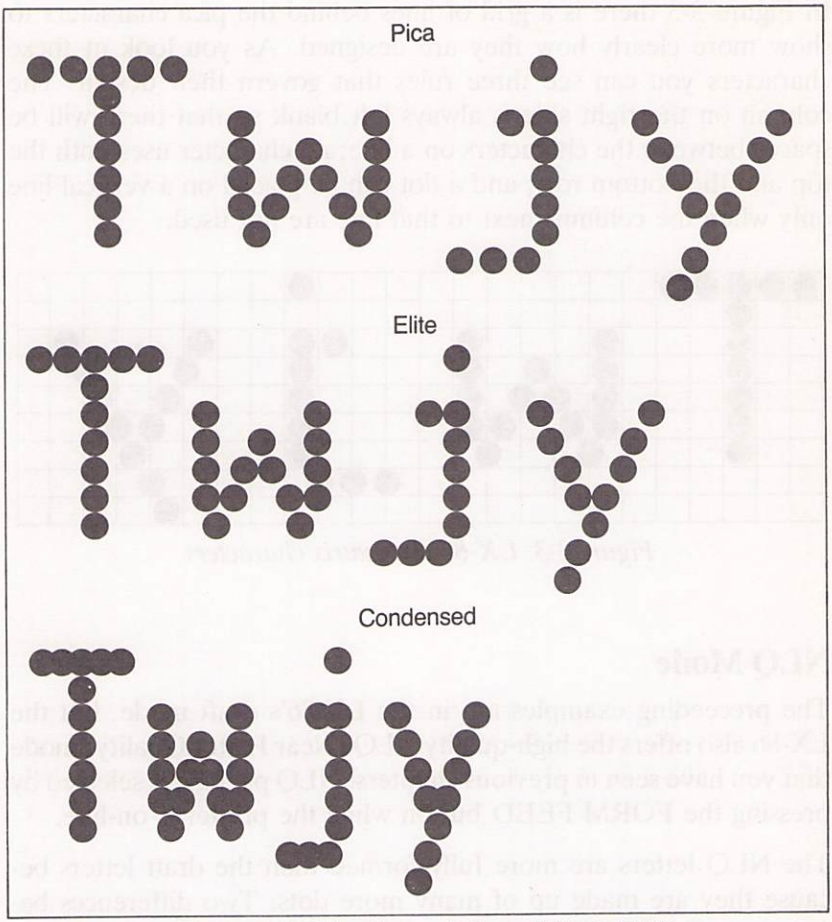


Figure 3-2. The three pitches of the LX-86

The dot pattern of each character is carefully designed so that in pica mode no dot overlaps another; in normal high-speed printing of pica the pins cannot fire and retract and fire again quickly enough to print one dot overlapping another.

In Figure 3-3 there is a grid of lines behind the pica characters to show more clearly how they are designed. As you look at these characters you can see three rules that govern their design. The column on the right side is always left blank so that there will be spaces between the characters on a line; no character uses both the top and the bottom row; and a dot can be placed on a vertical line only when the columns next to that line are not used.

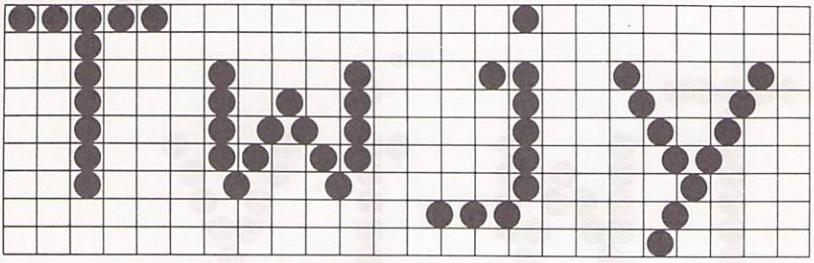


Figure 3-3. LX-86 dot matrix characters

NLQ Mode

The preceeding examples are in the LX-86's draft mode, but the LX-86 also offers the high-quality NLQ (Near Letter Quality) mode that you have seen in previous chapters. NLQ printing is selected by pressing the FORM FEED button while the printer is on-line.

The NLQ letters are more fully formed than the draft letters because they are made up of many more dots. Two differences between draft and NLQ printing enable the LX-86 to print such a large number of dots for each character. In the NLQ mode, the head moves more slowly, so that dots can overlap horizontally, and each character is printed by the head moving back to the beginning of the line and printing more dots on top of the first ones. This is known as a double pass.

To further ensure the quality of NLQ characters, both passes of the print head are in the same direction so that the alignment of the dots is exact.

Because the NLQ mode uses two passes for each line and prints only in one direction, printing does take longer in this mode.

With the two modes, draft or NLQ, the LX-86 gives you the ability to choose high speed or high quality respectively each time you print. You can print ordinary work or preliminary drafts quickly in the draft mode and use the NLQ mode for final copies or special purposes.

Draft mode is the default setting when the printer is first turned on. You can change easily from draft to NLQ by pressing the FORM FEED button, or back to draft by pressing the LINE FEED button, while the printer is on-line. You can also select and cancel the NLQ mode with a software command as explained in Chapter 5.

Chapter 4
Printer Control Codes

The LX-86 printer is easy to use, especially with commercial software which has print control features. This chapter explains some of the basics of printer control and helps you understand how a computer communicates with the printer. This information should also enable you to understand the terms used in the software or computer manual.

If you are an advanced user or a programmer, you may want to turn to Appendix C, where there is a full summary of all the LX-86 commands.

ASCII Codes

When you type in a document using a word processing program, you press keys with letters or numbers on them and when you send the document to a printer, it prints the corresponding letters and numbers onto the paper. The computer and the printer, however, do not use or understand letters of the alphabet. They function by manipulating *numbers*. Therefore, when you press the **A** key, for example, the computer sends a number to its memory. When the computer tells the printer to print that letter, it sends the number to the printer, which must then convert the number to a pattern of pins that will fire to print the dots that make up that letter.

The numbers that computers and printers use are in binary form, which means that they use only the digits 0 and 1. In this manual, however, we use decimal numbers in our explanations because most users are more familiar with these numbers and because most programming languages and applications programs can use decimal numbers. The computer system or the program takes care of changing the decimal numbers to binary form.

Computer and printer interaction would be terribly confusing if different kinds of computers and printers used different numbers for the same letter of the alphabet. Therefore, most manufacturers of computers, printers, and software use the American Standard Code for Information Interchange, usually referred to as ASCII (pronounced ASK-Key). The ASCII standard covers the decimal numbers from 0 to 127 and includes codes for printable characters (letters, punctuation, numerals, and mathematical symbols) and a few control codes, such as the codes for sounding the bell and performing a carriage return.

Although other codes are not standardized in the computer industry, the ASCII system means that at least the alphabet is standardized. A programmer or engineer knows, for example, that 72 is the decimal code for a capital **H** and 115 is the code for a lower case **s** no matter what system he or she is using.

ESCape Code

Although the original ASCII standard was designed to use the decimal numbers 0 through 127, computer and printer manufacturers soon extended this range (to 0 through 255) in order to make room for more features. On the LX-86, for example, the codes from 160 through 254 are used for italic characters. Because even this extended range is not enough for all the features used on modern printers, the range is further extended with a special code called the Escape code. This code is often printed with the first three letters capitalized (ESCape) or abbreviated as ESC or <ESC>.

When the <ESC> code, which has the decimal value 27, is used, printers and computers are not restricted to only 256 instructions. The <ESC> code is a signal that the next code will be a printer control code instead of text to print. For example, if the printer receives the number 69, it prints a capital **E** because 69 is the ASCII code for that letter. If, however, the printer receives code 27 just before the 69, it turns on emphasized mode, because <ESC> E is the code sequence for emphasized.

You can see how important the <ESC> code is by looking at Appendices B and C. You will see that nearly every code the LX-86 uses is an <ESC> code.

Printer Codes

To take advantage of the many print features of the LX-86, you can use a software program that sends the correct codes or you can use another method to send instructions to the printer. It is not possible to be as precise and specific as we would like in this chapter because the LX-86 works in combination with so many different applications programs and computer systems.

However, this chapter will lay down the general principles of how software communicates with the printer, plus several ways in which the codes of the LX-86 are used by word processing and business programs. With this information and possibly some help from your dealer or the operating manual for the applications program, full advantage can be taken of all the features of the LX-86 that you wish to use. Incidentally, there is no standard terminology for software codes; thus, the terms in the software manual may differ from the ones used here.

There are a number of ways of sending printer codes with commercial software:

- Using SelecType, as described in Chapter 2.
- Instructing the program during an installation or setup procedure enabling you to use special codes that are typed in along with your text or data. These will be referred to as "software command" codes.
- Inserting LX-86 printer codes in the text enclosed by special instruction characters which tell the printer that the "embedded" codes are not text or data, but special codes for the printer.

There are three common formats for inputting printer codes either into the program or inserting them into the text. The applications software or its manual should tell you which one to use.

- Decimal numbers — 27, for example is the decimal number for the <ESC> code, and 13 is the decimal number for a carriage return.
- Hexadecimal numbers (sometimes abbreviated to hex), for example in which the <ESC> code is 1B and a carriage return is 0D. You do not have to understand hexadecimal numbers to use them. If your software calls for hex numbers, just consult Appendix C or the Quick Reference Card for the appropriate number.

- Entering the code directly from the keyboard by pressing special combinations of keys. It is normally possible to use a special key called the control key which is usually marked CTRL or CONTROL, in conjunction with the remaining keys. The <ESC> code can frequently be obtained by pressing a key marked ESC or ESCAPE. However, in some cases the computer returns a different character because it is intended to escape from a particular situation. A table showing which keys to press for each code is given in Appendix A. For example, a carriage return can be obtained by pressing the control key and the M key at the same time.

Software command codes

A program that uses software command codes has its own set of codes that you type into the document or file. When the program receives one of these codes, it sends the proper code to the LX-86. For example, in one popular word processing program you can cause a block of text to be printed in italic mode by pressing the control key together with the P key at the start of the text. Pressing the control key together with the Q key at the end of the block of text returns you to normal printing. You can see these on the screen as ΛP and ΛQ. They are not printed as such, but when the ΛP (control P) is reached in the text being sent to the printer, the program sends the correct code to turn the italic mode on. When the ΛQ (control Q) is reached, the code to switch off italic mode is sent. It does not send the ΛP or ΛQ, which are merely markers in the text telling the word processor program what to do. The program finds the codes from a table which either the manufacturer of the software provides or you can make yourself. Please note that these codes are part of the word processor program and do not have the same function as the control key codes mentioned above which are the ones the printer itself understands.

In order for the table of codes to be correct for your particular printer, you have to run a setup or install program when you first use the package. Often the program simply asks you the type of printer you have. Once you tell such a program that you are using an Epson printer, it will know which codes to send. (Often you do not need to specify which Epson printer you are using.) In some cases the table is built up as answers to a series of questions. The answers to the sequences are given in Appendix C. The instructions should be in the software manual. In addition, your software or computer dealer may be able to help you.

Inserting codes directly into the text

Some software packages are more versatile in that they allow you to enter any set of codes you like, embedding them between a pair of markers so that the program knows that they are special and not text or data. This is slightly more difficult since you have to use Appendix C regularly to decide which codes you need. In one such program, for example, typing Control-V (pressing **V** while holding down the control key) signals the beginning of printer instructions. Then you enter the print codes by pressing various combinations of Control and alphanumeric keys and then type Control-V again to signal the end of the printer instructions.

If the word processing program allows you to insert the actual codes required, you can use SelecType to set the print mode for the whole document. It is only for special features that you will need to use embedded codes. For example, if you want to have headings in wide bold printing (called double-width emphasized), you would probably have to use embedded codes. For the program we mentioned above you would type Control-V, then the code for double-width emphasized. If the double-width is to be switched off after one line, ASCII 14 is the code required. The emphasized code sequence is <ESC> E. Thus the codes to go into the word processor would be Control-N to give the ASCII 14, followed by <ESC> and then an upper case letter E. Finally the embedded text marker is given with a Control-V again, and then the text of the heading. Further information on the codes is given in Appendices A, B and C.

Again, if this sounds too complicated, don't worry. Use the LX-86 with the standard features of the word processing program until you become more familiar with both of them. Then you can decide whether or not you need or want to learn to use embedded codes.

Programming Languages

If neither of the methods described above seems appropriate for your application, you can write a program in BASIC or any other programming language to send control codes to the printer before you run your applications program. In the chapter on page formatting you will find examples of such programs. Just remember that with this method the printer control code stays in effect for the whole document you print. This method works for a wide range of commands and is good for setting margins, for example, but does not work for italicizing a word. It has the same drawback as SelecType in this context and is only of use for whole documents.

Now you have some background on how printers work and how software can communicate with them. Turn to the next chapters to learn about the specific features of the LX-86 printer.

Chapter 5
LX-86 Features

This chapter and later chapters describe some of the printing features of the LX-86 and although it includes programs that demonstrate these features, you do not have to be a programmer to use them.

Demonstration Programs

The description and examples of the LX-86 features are accompanied by demonstrations in the BASIC programming language which enable you to see these features in action. Although you may not do much of your printing using BASIC, it was chosen for the demonstrations because most computer systems include some form of BASIC, and the examples are ones that almost every one of you can try out.

You only need to know a little about BASIC to type in and run these programs. Running the programs, reading the explanations and looking at the printed examples, show you how the LX-86 responds to the messages the computer sends it by printing letters, numbers, symbols, and graphics in various print modes.

Even if you never use BASIC again, you will know the capabilities of the printer, capabilities that can often solve your printing problems. For example, if you need a special symbol, you will know that you can turn to the chapter on user-defined characters and create such a character.

The exercises in BASIC are not absolutely essential. Many users are quite happy with their printers without ever learning any more about them than how to turn them on and off and how to load paper. In most cases the software that you use for word processing, business, or graphics does the calculating and communicating with the printer for you.

In fact, because of Epson's long-standing popularity, many programs are designed to use Epson printers as standard. Often all that you need to do is specify in an installation program that you are using an Epson printer. Then the program sends the correct codes for the various printing functions. The installation process, if there is one, is explained in the manual for your software program.

The examples in this manual are in Microsoft BASIC (MBASIC), one of the most widely used versions of BASIC in personal computers, and most users can enter and run the programs exactly as they appear in these pages.

If your computer system uses any other kind of BASIC, you may have to make a few changes. Probably the only item you will need to change is the instruction LPRINT, which is the MBASIC command to send something to the printer. Applesoft BASIC, for instance, uses PR#1 at the beginning of a program to route information to the printer and PR#0 at the end to restore the flow of information to the screen. BBC BASIC starts sending information to the printer with the VDU2 command and stops with VDU3. In both cases all output to the screen made by PRINT statements also goes to the printer. If you have such a system, use the command to turn the printer on and then use PRINT instead of LPRINT in the programs. If you have any other system, consult its manual to see if any modifications to the programs in this manual are necessary. Specific problems with your computer may also be outlined in Appendix F.

In Chapter 3, Figure 3-2 showed the enlargements of the three LX-86 pitches. Chapter 2 showed how to choose them with SelecType. The rest of this chapter is concerned with changing the pitch and setting NLQ characters under software control.

Pica Printing

The first exercise is a simple three-line program to print a sample line of characters in pica, the standard pitch. Just type in this program exactly as you see it:

```
40 FOR X=65 TO 105
50 LPRINT CHR$(X);
60 NEXT X: LPRINT
```

Now run the program. You should get the results you see below, 10 pica characters per inch.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
```

Other Pitches

As explained in Chapter 3, the LX-86 uses the same pattern of dots for pica, elite, and condensed characters, but it changes the horizontal spaces between the dots to produce the three different widths.

In elite mode there are 12 characters per inch, and in condensed there are 17.16. The LX-86 prints in elite when it receives the <ESC> M command and prints in condensed when it receives the ASCII 15 command. Print a sample line of elite characters by adding this line to your previous program:

```
20 LPRINT CHR$(27)"M";
```

This line uses the command <ESC> M, to turn on elite mode. Your printout should look like this:.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
```

Now add a line to the program to cancel elite with <ESC> P and turn on condensed with ASCII 15:

```
30 LPRINT CHR$(27)"P"CHR$(15);
```

Run the program to see the line printed in condensed mode.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
```

Cancelling Codes

As you saw in the third version of the print pitch program, you must cancel a code when you do not want it any more. With very few exceptions, the LX-86 modes stay on until they are cancelled. It is important to remember this because an LX-86 mode can stay on even if you change from BASIC to another type of software. For example, if you print a memo with a word processing program after you run the program above, the printer will still be in condensed mode, and so the memo will be in condensed print. To cancel condensed mode, use ASCII 18.

To avoid having one program interfere with the printing modes of another, you can cancel a mode in one of two ways:

- Using a specific cancelling code to just cancel one mode. The <ESC> P in the last line of the program in the previous section was used to cancel elite. Each mode has a cancelling code, which you can find in the discussion of the code and in Appendix B. Pica is an exception to this rule. To cancel pica, turn on elite or condensed.
- Resetting the printer, a method explained in the next section.

Resetting the Printer

Resetting the LX-86 cancels all modes that are turned on. You can reset the printer with one of two methods:

- Sending the reset code (<ESC> "@")
- Turning the printer off and back on.

These two methods return the printer to what are called its defaults, which are the standard settings that are in effect when you turn the printer on. The two effects of resetting the printer that you should be concerned with are: it returns the printing to single-strike pica, thus cancelling any other pitches or enhancements you may have turned on, and the current position of the print head becomes the top of page setting.

It is also possible to use SelecType to return to single-strike pica without resetting any other codes to their defaults.

Some of the demonstration programs end with a reset code so that the commands from one program will not interfere with the commands in the next one. After you run a program with a reset code in it, remember to change the top of page setting before you begin printing full pages.

Pitch Comparison

Now that you have used three short programs to produce samples of the three main pitches, you can choose the pitch that you prefer or the one that best fits a particular printing job. Most people use either pica or elite for printing text and condensed for spreadsheets or other applications where it is important to get the maximum number of characters on a line.

In fact, if you need even more than the 132 characters per line that condensed gives you, you can combine elite and condensed for a mode. It is not really another pitch, because the size of the characters is the same as in the condensed mode; only the *space between* the characters is reduced. You can see this mode, which allows 160 characters to fit on a line, if you replace line 30 in your last program with this line:

```
3Ø LPRINT CHR$(15);
```

With this addition, the program turns on condensed but doesn't turn off elite, giving you the printout below:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
```

If your printout is different, you may need a WIDTH statement. This is described further in Appendix F. The format for your system may be different. Consult your BASIC manual. It will probably take the form:

```
5 WIDTH LPRINT 255
```

As a comparison, the output for straight condensed is:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
```

Near Letter Quality Mode

The examples so far in this chapter are in the draft mode, and you have already learned how to turn on the NLQ mode with the FORM FEED button, but you can also set the NLQ mode with the following program:

```
1Ø LPRINT CHR$(27)"x"CHR$(1);
2Ø FOR X=65 TO 1Ø5
3Ø LPRINT CHR$(X);
4Ø NEXT X: LPRINT
```

Note that you use a lower case x, not a capital X, in line 10. Because of the high resolution of the NLQ mode, it prints only in pica, not in elite or condensed.

All the modes demonstrated in this chapter are compared in Table 5-1.

Table 5-1. Summary of LX-86 pitches

Print sample	CPI	Codes	
← 1 inch →		On	Off
Near Letter Quality	10.00	ESC "x" 1	ESC "x" 0
Pica print	10.00		
Elite print	12.00	ESC "M"	ESC "P"
Condensed print	17.16	15	18
Condensed elite print	20.00	ESC "M" 15	ESC "P" 18

Remember that you do not have to use BASIC to change modes; you can use any method that sends the printer the proper codes.

Chapter 6
Print Enhancements and Special Characters

The LX-86 cannot only change the pitch — it has many more ways of varying and enhancing printing. To avoid your having to type in dozens of programs to try all the features, this chapter gives you just one master program that can demonstrate any feature.

Bold Modes

Besides the pitches (pica, elite, and condensed) covered in Chapter 5, the LX-86 offers many other typestyles, including two for bold printing—emphasized and double-strike.

Emphasized mode

In the emphasized mode the LX-86 prints each dot twice, with the second dot slightly to the right of the first. In order to do this, the print head must slow down so that it has time to fire, retract, and fire the pins quickly enough to produce the overlapping dots. As you can see in Figure 6-1, this method produces better-looking, more fully-formed characters that are darker than single-strike ones.

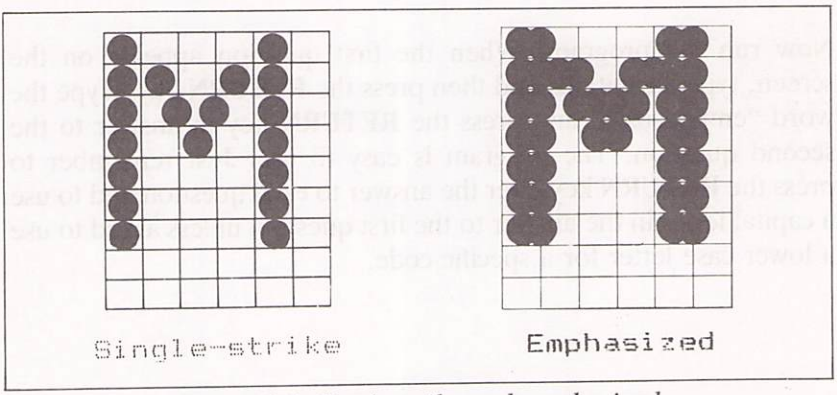


Figure 6-1. Single-strike and emphasized

Emphasized works only in draft pica and NLQ modes. In elite and condensed the dots are already so close together that even with the reduced print speed, the LX-86 cannot fire, retract, and again fire the pins quickly enough to print overlapping dots.

You do sacrifice some print speed and ribbon life with emphasized, because the print head slows down and prints twice as many dots, but the increase in print quality is well worth it. Indeed, you may want to use emphasized instead of the NLQ mode for some purposes because emphasized printing is faster than NLQ printing.

The following master program allows you to test almost any of the <ESC> codes, including the <ESC> code to turn on emphasized: <ESC> E.

Master program

First, type in the program below. If you have some programming experience, you can see that it asks you what codes you want to test and then prints a sample of printing after the code has been given so that you can see what the codes do. Ensure that you have typed the blank spaces in lines 70 and 80. If you are using a BASIC which does not have the LPRINT command, go to Appendix F to check how to modify the program.

```
20 PRINT "Which ESCape code do you "
30 INPUT "want to test";A$
40 PRINT "What kind of printing "
50 INPUT "does it produce";B$
60 LPRINT CHR$(27)A$
70 LPRINT "This sample uses ESCape ";A$
80 LPRINT "to produce ";B$;" printing."
90 LPRINT CHR$(27)"@"
```

Now run the program. When the first question appears on the screen, type a capital **E** and then press the **RETURN** key. Type the word "emphasized" and press the **RETURN** key in answer to the second question. The program is easy to use. Just remember to press the **RETURN** key after the answer to each question and to use a capital letter in the answer to the first question unless asked to use a lower case letter for a specific code.

You should get the following printout when you run this program and type the letter E and "emphasized" in answer to the questions.

```
This sample uses ESCape E
to produce emphasized printing.
```

The code to turn off emphasized is <ESC> F.

Double-strike

The other bold mode on the LX-86 is double-strike. For this mode the printer prints each line, then moves the paper up slightly and prints the line again. Each dot is printed twice, with the second one slightly below the first as you can see in Figure 6-2.

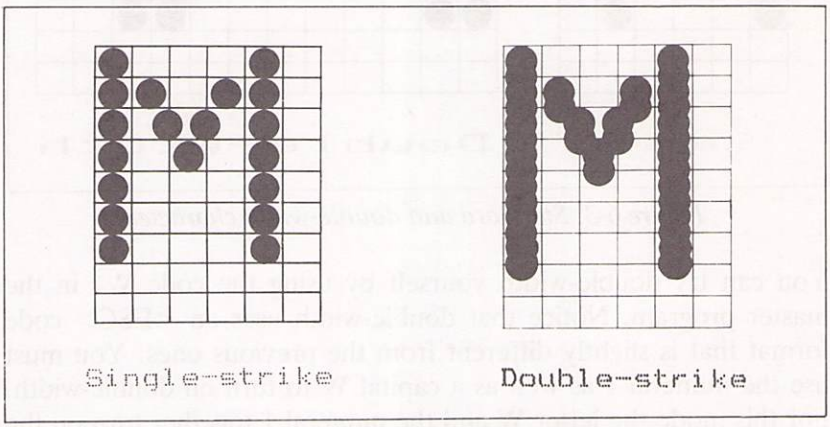


Figure 6-2. Single-strike and double-strike

Unlike emphasized, double-strike combines with any draft pitch (but not with NLQ) because it does not overlap dots horizontally. Since each line in this mode is printed twice, the speed of printing is slowed down. The code for double-strike is <ESC> G. Try it in the the master program if you wish. The code to turn off double-strike is <ESC> H.

Double-width Mode

Perhaps the most dramatic mode on the LX-86 is double-width. It produces extra-wide characters that are good for titles and headings. For this mode, the dot pattern of each character is double-width and a duplicate set of dots is printed one dot to the right. You can see the difference between pica and double-width pica in Figure 6-3.

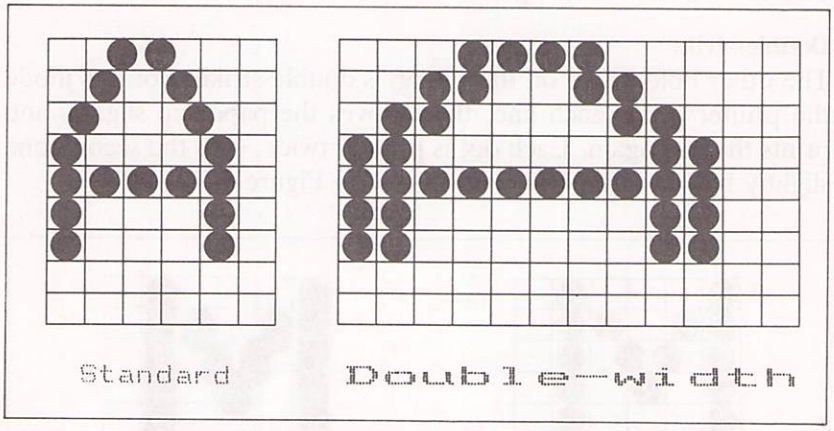


Figure 6-3. Standard and double-width characters

You can try double-width yourself by using the code W1 in the master program. Notice that double-width uses an <ESC> code format that is slightly different from the previous ones. You must use the numeral 1 as well as a capital W to turn on double-width. For this mode the letter W and the numeral 1 together turn on the mode and the letter and the numeral 0 together turn it off. Thus <ESC> W1 turns on double-width and <ESC> W0 turns it off.

Those of you who are programmers may be interested in another form of double-width. In this alternate form, called one-line double-width, the printing is the same as that in Figure 6-3, but it is turned on by ASCII 14 and is turned off by a line feed, ASCII 20, or <ESC> W0.

Italic Mode

You may occasionally want to print italic words for emphasis, titles, or other uses. The LX-86 has another pair of sequences to allow you to switch italic mode on and off. Although characters produced by the previous modes in this manual are modifications of the standard pica characters, the LX-86 uses completely different characters for the italic mode. You can see the difference between standard and italic draft characters in Figure 6-4.

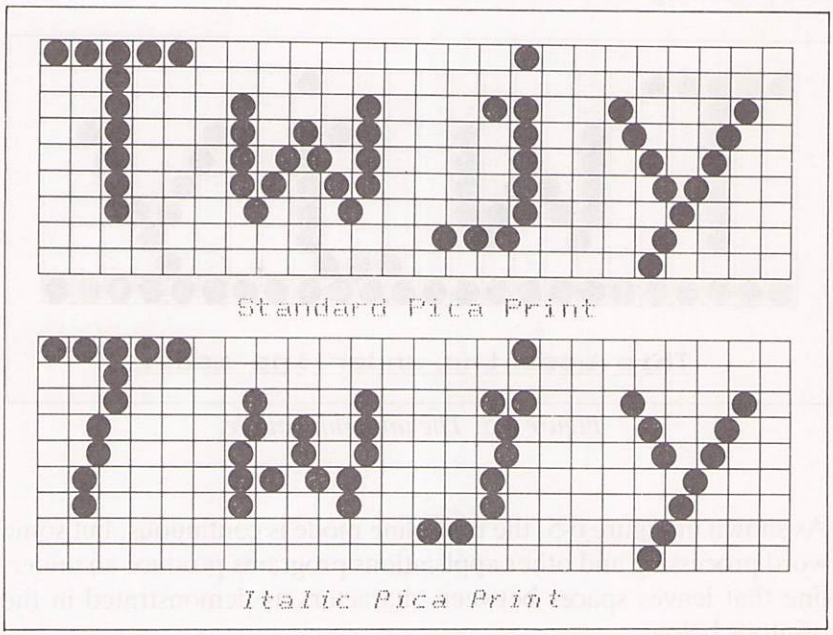


Figure 6-4. Pica and italic print

The code to turn italic mode on is <ESC> 4. Try it in the master program if you wish. When you use this code in the master program, enter 4 in answer to the first question just as if it were a letter of the alphabet instead of a number. <ESC> 5 turns off italic mode.

Those of you who use this code in an applications program should remember that any number used in discussions of <ESC> codes is an alphanumeric character, not a numerical value.

Underline Mode

The LX-86 also has a mode that will underline characters and spaces. You turn it on with <ESC> −1 and off with <ESC> −0. Note that the underline code is like the enlarged code in that it uses a character, in this case the hyphen or minus sign, combined with the numerical character 1 to turn it on and a character combined with the numerical character 0 to turn it off. As you can see in Figure 6-5, this mode prints a dot in the bottom row of each column, thus producing a continuous underline.

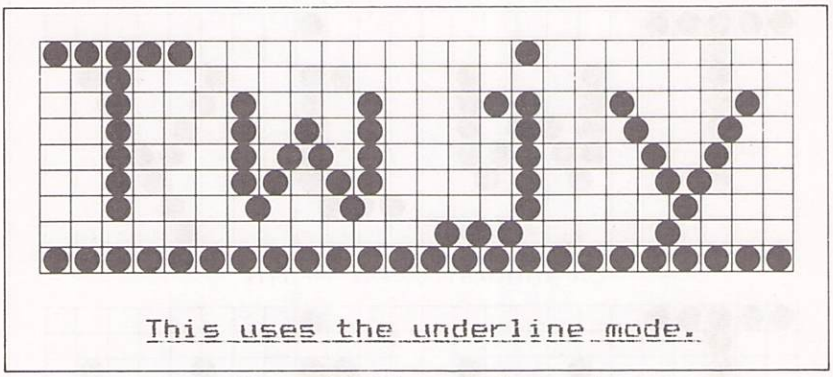


Figure 6-5. The underline mode

As shown in Figure 6-5, the underline mode is continuous, but some word processing and other applications programs produce an underline that leaves spaces between characters as demonstrated in the printout below.

```
This uses the underline character.
```

If the software prints this type of underline, it is using the LX-86's underline character (ASCII 95), not the underline mode. Because the underline character is only five dots wide, it does not fill the spaces between characters. If you prefer a continuous underline, you may be able to use the underline mode through one of the methods we discussed in Chapter 4.

Master Select

The LX-86 has a special <ESC> code called Master Select that allows you to choose any possible combination of eight different modes: pica, elite, condensed, emphasized, double-strike, double-width, italic, and underline. The format of the Master Select code is <ESC> ! followed by a number that is calculated by adding together the values of the modes listed below:

underline	128
italic	64
double-width	32
double-strike	16
emphasized	8
condensed	4
elite	1
pica	0

For any combination, just add up the values of each of the modes you want and use the total as the number after <ESC> !. For example, to calculate the code for double-width italic underlined pica, add the following numbers together:

underline	128
italic	64
double-width	32
pica	0
	224

To print this combination, therefore, you use <ESC> ! followed by the number 224. In BASIC the command is:

```
2Ø LPRINT CHR$(27);"!";CHR$(224);
```

To try this or any other number, enter and run this short program, which will ask you for a Master Select number and then give you a sample of printing using that code. Again, if you are using a computer with BASIC that does not use the LPRINT command, see Appendix F.

```
1Ø INPUT "Master Select number";M
2Ø LPRINT CHR$(27)"!"CHR$(M)
3Ø LPRINT "This sample of printing uses "
4Ø LPRINT "Master Select number";M
5Ø LPRINT CHR$(27)"@"
```

In this program, you can use any number you have calculated with the formula above, but remember that emphasized cannot combine with condensed or elite. If you try to combine emphasized with either of the two narrow pitches, you will not harm the printer; it will simply use a priority list in its memory to determine which mode to use. This priority list causes a combination of emphasized and elite to produce elite only, a combination of emphasized and condensed to produce emphasized only, and a combination of all three to produce condensed elite.

Master Select is a powerful code that gives you an easy way to produce multiple combinations with a single command. To see double-strike emphasized italic printing, for example, you need only one <ESC> code instead of three.

Indeed, Master Select is such a powerful feature that it may occasionally be more powerful than you want it to be. Because it controls eight different modes, a Master Select code will cancel any of those eight that are not selected. For example, suppose that you have a page in elite and want part of it to be printed in italic. If you use <ESC> ! 64 to turn on italic, the LX-86 will begin printing in italic pica instead of italic elite because the 64 code does not include elite. Use 65 for italic elite.

If you are not using BASIC, and therefore do not have a command like CHR$( ) to send an ASCII code simply by inserting a number in the command, you will have to find a character which corresponds to the required number. Appendix A may help you, or there may be a similar table in your computer manual. In all cases the number referred to in the command must be sent as an ASCII code. As an example of using a character instead of a number, if you wish to send the sequence <ESC> ! 65 to set italic elite, you should send <ESC> ! A, since the letter A has the ASCII code 65.

Superscript and Subscript

Your LX-86 can also print superscripts and subscripts, which you can use for mathematical formulae, footnotes, and other items that require numbers or letters above or below the usual print line. <ESC> S0 turns on superscript and <ESC> S1 turns on subscript. <ESC> T turns off either one. You can enter either <ESC> S0 or <ESC> S1 in the master program, but that will print the whole sentence in superscript or subscript. Some more realistic examples are below:

```
E=MC²
H₂0
This fact is found in three sources.⁷
```

As you can see, you can use superscript or subscript for an individual character. Just find out how to send printer codes in your applications program; then send the proper codes to the printer.

International Characters

When printing in languages other than English, you will need extra or different characters. The LX-86 has provided for printing in many languages by having 96 international characters in its ROM (Read Only Memory). This total includes characters in two sets: draft and NLQ (Near Letter Quality).

To print any of these characters, several methods are available. One way is to first select one of the following character sets and then use the individual characters within that set.

0	USA	6	Italy
1	France	7	Spain
2	Germany	8	Japan
3	United Kingdom	9	Norway
4	Denmark I	10	Denmark II
5	Sweden		

You select the character set in one of two ways: with an <ESC> code or with a switch in the back of the printer. The <ESC> code in BASIC has the following format:

```
LPRINT CHR$(27)"R"CHR$(n)
```

in which n stands for the appropriate number from the list above. In other words, the BASIC command to select the French character set is.

```
LPRINT CHR$(27)"R"CHR$(1)
```

You can also select one of the international character sets with the small switches, called DIP switches, in the back of the printer. If you plan to use one of the international sets quite a bit, see Appendix D for instructions for using the DIP switches. This makes it so the character set is automatically selected as a default setting when you first turn on the printer.

Once you have selected a character set, whether you do it with an <ESC> code or the DIP switches, you will be able to print several new characters. The character sets are shown in Tables 6-1 and 6-2.

The number at the top of each column in the tables is the ASCII code that prints the characters in that column.

One other means is available for selecting international characters. This is to send the printer a software command which turns on all of the international character sets at the same time. You do this by sending CHR$(27) "6" in BASIC, which causes the upper control codes (such as the upper code for line feed) to be used instead for the complete international character set. Then, to print a desired international character, you send the code that corresponds to that character. To see which characters are printed for which codes, turn to Appendix A.

Note: Two different sets of international characters are available using <ESC>6 depending on whether the standard character set or the character/graphic set has been selected.

Once you have selected an international character set with the DIP switches or the <ESC> R code, you can use the tables to see which characters on the standard USA keyboard will produce the international characters you want. Simply type the character from the top row of one of the figures in order to print the corresponding character in the row of the set you have chosen. For example, if you have

reset the DIP switches for the UK character set and you press the # key, the £ symbol will be generated. Even though you will see the # symbol on the screen, the £ symbol will be printed on the paper. For another example, if you have selected the Swedish character set and you press the @ key, the É symbol will be generated.
If your keyboard does not have one of the keys that you need, find the character you want to send and then look dowm the column to find which character corresponds to that character in your country. If your computer is using a standard ASCII set, and you have set the international characters using the <ESC> R command, when you print the character you have found on your keyboard, it will be printed as the corresponding character for the country you have chosen. If the result is wrong compare the table in Appendix A with the corresponding chapter in your computer manual.

Table 6-1. International characters in NLQ mode

	35	36	64	91	92	93	94	96	123	124	125	126
USA	#	$	@	[	\	]	^	`	{	¦	}	~
FRANCE	#	$	à	°	ç	§	^	`	é	ù	è	¨
GERMANY	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
UK	£	$	@	[	\	]	^	`	{	¦	}	~
DENMARK I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
SWEDEN	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
ITALY	#	$	@	°	\	é	^	ù	à	ò	è	ì
SPAIN	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
JAPAN	#	$	@	[	¥	]	^	`	{	¦	}	~
NORWAY	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
DENMARK II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

Table 6-2. International characters in draft mode

	35	36	64	91	92	93	94	96	123	124	125	126
USA	#	$	@	[	\	]	^	`	{	¦	}	~
FRANCE	#	$	à	°	ç	§	^	`	é	ù	è	¨
GERMANY	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
UK	£	$	@	[	\	]	^	`	{	¦	}	~
DENMARK I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
SWEDEN	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
ITALY	#	$	@	°	\	é	^	ù	à	ò	è	ì
SPAIN	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
JAPAN	#	$	@	[	¥	]	^	`	{	¦	}	~
NORWAY	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
DENMARK II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

The number at the top of each column in the tables is the ASCII code that prints the characters in that column.

Character/Graphic Set

The character/graphic set includes characters used by IBM and compatible computers. The characters in the set are shown in Appendix A.

You select the character/graphic set in one of two ways: with an <ESC> code or with a DIP switch.

The <ESC> code in BASIC has the following format:

```
LPRINT CHR$(27)"t"CHR$(N)
```

If n is 1, the command turns the character/graphic set on; if n is 0, the command turns that set off.

If you prefer to have the character/graphic set on most of the time, see Appendix D for instructions on using the DIP switches.

Special Graphics Character Set

The LX-86 printer's Read Only Memory (ROM) also contains 32 other graphic characters which are compatible with Epson portable computers. These are shown in Figure 6-6.

128	129	130	131	132	133	134	135	136	137	138
┼	┴	┬	┤	├	─	│	┌	┐	└	┘
139	140	141	142	143	144	145	146	147	148	149
▒	▓	▬	▐	▀	○	♠	♣	♦	♥	♪
150	151	152	153	154	155	156	157	158	159	
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	

Figure 6-6. special graphics character set

Undoubtedly you can think of uses for many of the shapes and symbols available in this set, and you can combine the line graphics characters (the ones on the first row) to form various sizes and shapes of boxes and other figures that use straight lines.

To print these graphics characters you must use either a programming language or a computer with a graphics shift or other special key that allows you to send graphics codes. The characters do not have to be the ones in your computer, because the printer does not know which numbers represent which graphics character in your computer. There is no standard to correspond to the ASCII codes for the alphabet for such graphics characters.

Sending the codes for these characters to the printer is a two-step process just as it was for the special graphics character set. You first send the code to enable the set. This code has the following format:

```
LPRINT CHR$(27)"m"CHR$(4)
```

Then you send the code numbers given in Figure 6-6.

You can change pitch and weight with the graphics characters just as you can with the other characters in the ROM of the LX-86. The characters in Figure 6-6, for instance, are printed in double-width elite. The printout below shows the special graphics characters in pica:

The next printout shows the special graphics characters in emphasized double-width pica:

Because normal line spacing leaves space between the lines of graphics characters just as it does between lines of text, you must change the line spacing when you combine line graphics characters. Further details on setting line spacing are given in Chapter 7.

Although you can use any print mode with the graphics characters, you should not use elite or condensed. These modes cause small gaps in horizontal lines formed by a combination of line graphics characters.

Chapter 7
Page Formatting

The LX-86 printer has many sophisticated commands to set margins, line spacing, and horizontal and vertical tabs. Most of these functions are duplicated by applications programs which use them in calculations for the layout you have specified in the program. This chapter describes a few commands that the average user might need. If you want more information, you can find all the commands in Appendices B and C.

Top of Page and Page Length

When you are printing a long document using continuous paper it is important to make the individual pages of the document fit correctly on each page. If the paper is not set in the printer correctly, the pages will start being printed in the centre of one of the sheets of paper, the middle will be on the perforation, and the end will be in the middle of the next sheet. When you switch the printer on, it assumes that the paper is in the correct position at the top of the page. Consequently if you move the paper using the paper feed knob, the printer (or indeed your applications software) does not know this has happened and gets out of step with the actual top of the page. The best way to set the top of page and make sure the printer keeps the page is as follows:

When you have inserted a new piece of continuous paper, move the paper forward until the first perforation sits level with the top of the ribbon guide (Figure 1-6) using the paper feed knob. You then need to tell the LX-86 that it is at the top of the paper. You can do this by sending a software initialization command <ESC> @ as in Chapter 5, or more conveniently by switching the power off and on again.

When you move the paper, do so by pressing the ON LINE button so that the printer is off-line, and then using the LINE FEED button to move it up individual lines or the FORM FEED button to move the paper to the top of the next page. If you do move the paper using the paper feed knob and you wish to check whether you have disturbed the top of page setting, use the FORM FEED button with the printer off-line to move the paper to where the LX-86 thinks the top of page is. Having found that it is not at the perforation, turn the paper feed knob to move the perforation to be in line with the top of the ribbon guide.

The distance travelled by the page when you press the FORM FEED button or when the computer sends a form feed command is normally 11 inches. If your pages are of a different length you can adjust the length in two ways. One of the DIP switches described in Appendix D allows you to specify the page length as 11 or 12 inches. You can also specify the length using a code sequence. There are two ways to make the specification. The code <ESC> C sets the length of the page by the number of lines at the current line spacing. The code <ESC> C0 sets the page length as a number of inches. The full syntax for using these codes is given in Appendix C.

Paper-Out Sensor

Under the platen (the black roller) of the LX-86 printer is a small switch that senses whether or not paper is in the printer. When the end of the paper passes this switch, it sends a signal that sounds the beeper and stops the printing. This is not only to save wear on the print head, ribbon and platen, but necessary to make sure that printing stops if you are printing a document on single sheets of paper and have to change the paper. The switch is at the back of the platen and so some distance from the head and so printing stops about 2 inches from the end of the page. Therefore, if you use single-sheet paper in the LX-86, you cannot print on the last 2 inches of each page without overriding this feature.

The paper-out sensor can be deactivated in two ways. One is a temporary solution using the code sequence <ESC> 8 to deactivate the paper-out sensor. You can send the <ESC> 9 code to set it on again. The second method is to permanently deactivate it by changing one of the DIP switches as described in Appendix D.

Although you can print to the end of the page with single-sheet paper, you must be careful. If the computer software does not realize you have to change the paper and does not tell you to change the

paper and signal you have done so, printing will continue onto the platen and the text you are trying to print out will have to be reprinted from that point. Most word processors have an option to allow you to work with single sheets of paper.

Some computer systems, however, ignore the <ESC> code and the DIP switch setting. If <ESC> 8 or the DIP switch setting does not solve this problem for you, see Appendix F for other solutions.

Skip Over Perforation

If you are using continuous pin-feed paper for printing program listings or other material not controlled by an applications program, you may find that the LX-86 prints right over the perforations between pages. The LX-86 has an <ESC> code to prevent this: the <ESC> N command. You send <ESC> N followed by the number of lines you want the LX-86 to skip at the bottom of a page. For example, in BASIC the following line will make the LX-86 skip the last six lines of each page.

```
10 LPRINT CHR$(27)"N"CHR$(6);
```

This will give you one inch of blank space at the bottom of each page. If you prefer to have half of the blank space at the top of the page and half at the bottom, simply set the top of page approximately three lines (1/2 inch) below the perforation as described above.

Margins

The LX-86 allows you to set the left and right margins with simple <ESC> sequences. The left margin command is <ESC> l followed by the number of the column you choose for the left margin. The right margin command is <ESC> Q followed by the column number of the right margin you want. For the left margin command, be sure to use a lower case letter l, not the figure one.

If the word processing program does not allow you to change the margins, you can send margin commands to the LX-86 in BASIC or another programming language before you print your documents. For example, if you prefer wider margins than your word processing program allows, run the following BASIC program before printing. This program gives you a left margin of 10 and a right margin of 60, but you can use any numbers you prefer for the margin commands.

```
1Ø LPRINT CHR$(27)"l"CHR$(1Ø);
2Ø LPRINT CHR$(27)"Q"CHR$(6Ø);
```

Such a program will also allow you to choose the margins you prefer for program listings. Just remember that once you run a program that sets margins, those margins remain in effect until you change them with new margin commands or turn off or reset the printer.

You should be aware that a few applications programs reset the printer before each document or file they print. These programs will, of course, cancel the new margin settings. See Chapter 2 to find out how to test for a reset code in your program.

The maximum right margins on the LX-86 printer are 79 in pica, 95 in elite, 136 in condensed, and 159 in condensed elite. For further information on this command see Appendix C.

Line Spacing

Ordinarily you don't have to concern yourself with how the printer moves the paper so that it doesn't print lines of text on top of one another. The LX-86 takes care of this without any special instructions. However, if you want to understand how line spacing works or you need to change the line spacing for a special application such as graphics, read this brief explanation of line spacing on the LX-86.

The movement of the paper between lines is called a line feed and the distance the paper moves is called a line space. In ordinary printing the line spacing is 1/6-inch, which produces six lines of print per inch. Figure 7-1 will help you visualize this spacing. As you can see in the figure, the standard (default) spacing is the same as 12 rows of dots. Since the LX-86 characters use nine rows of dots, the 12-dot line spacing leaves three blank rows between the lines of text.

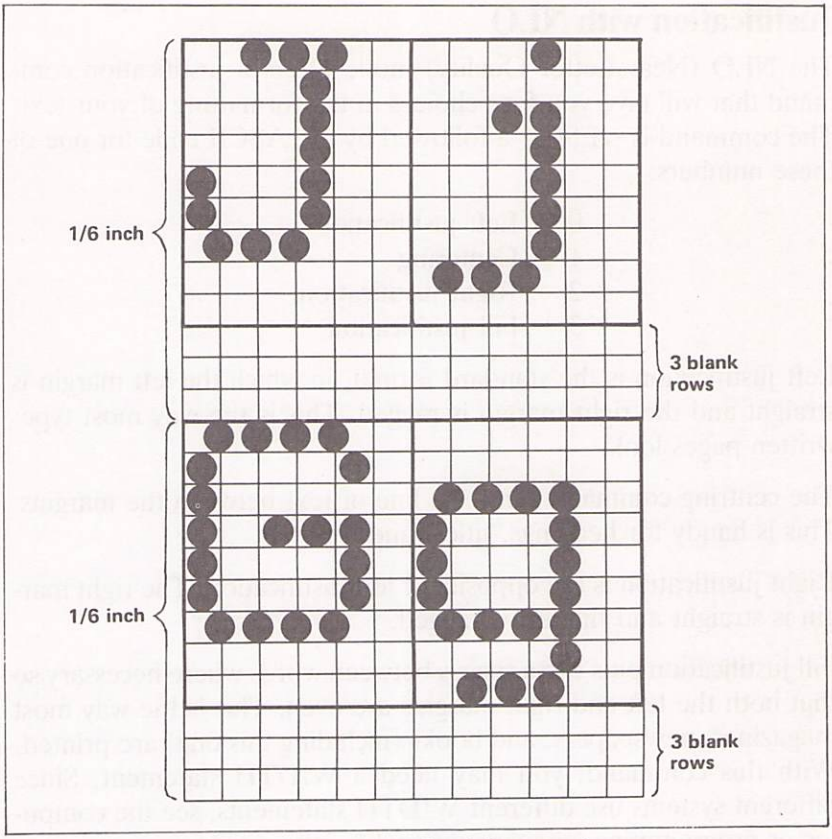


Figure 7-1. Standard line spacing

The default line spacing illustrated in Figure 7-1 is the only one you need for almost all printing of text, but in some cases you may want to increase or decrease the space between lines. The LX-86 has several commands to do this. <ESC> 0 decreases the line spacing to 9-dot (9/72-inch), <ESC> 1 decreases it to 7-dot, and <ESC> 2 returns it to 12-dot.

In addition, there are commands to specify the line spacing in 72nds of an inch and 216ths of an inch. If you need to make such fine adjustments in the line spacing, see Appendix B for the proper commands. In the chapter on dot graphics you will see how useful <ESC> 1 can be.

Justification with NLQ

The NLQ (Near Letter Quality) mode offers a justification command that will give you four choices in the formatting of your text. The command is <ESC> a followed by the ASCII code for one of these numbers:

0	Left justification
1	Centering
2	Right justification
3	Fill justification

Left justification is the standard format, in which the left margin is straight and the right margin is ragged. This is the way most typewritten pages look.

The centring command centres a line of text between the margins. This is handy for headings, titles, and captions.

Right justification is the opposite of left justification. The right margin is straight and the left is ragged.

Fill justification puts extra spaces between words where necessary so that both the left and right margins are even. This is the way most magazines, newspapers, and books (including this one) are printed. With this command, you may need a WIDTH statement. Since different systems use different WIDTH statements, see the computer or programming language manual for the proper format.

In using justification modes in the printer, you must send all characters to the printer one paragraph at a time. If you are using a word processor, it will calculate the numbers of characters on a line and split the words in the correct place. Thus you should not set justification in the printer if your word processor is also set to use it, since the two will conflict and you will not be able to predict the outcome.

When you use any of the justification commands, ensure that you have set NLQ mode first.

Chapter 8
User-Defined Characters

The LX-86 has several hundred different characters stored in its ROM (Read Only Memory). This number includes draft, italic, international, character graphics, special graphics, and Near Letter Quality characters. For those occasions when you need a special character or a few letters in a different typeface, the LX-86 allows you to create your own characters and print them just as if they were ordinary letters. You can only redefine six characters at a time.

Making full use of this facility requires that you have to write a program to create the characters. The programs in this chapter have been designed to do most of the work for you.

Defining Your Own Characters

The printout below displays a few such characters to give you an idea of what can be done. These characters are truly user-defined —you create what you need or want.

It may seem that designing a character and telling the LX-86 how to print it is complicated. In reality it is a routine procedure once you know what to do. The task has been reduced to a simple three-step process: planning your character, running one program that tests your work and calculates the required DATA numbers, and running another program to put the character in your printer's RAM (Random Access Memory) for use whenever you need it.

Because the high-resolution NLQ (Near Letter Quality) mode uses many more dots per character than the draft mode, defining NLQ characters is somewhat more complex than defining draft characters. A separate program for defining NLQ characters can be found at the end of this chapter.

After you have created your own characters with these programs, certain characters which you seldom use will be printed as the user-defined characters. For example, you could type = to print ↑.

Your user-defined characters can be utilitarian or imaginative, anything from a scientific symbol to script letters for your initials. Just follow the simple steps below.

The only restriction on your creativity is that the characters you define must follow the same rules that govern the rest of the characters printed by the LX-86. They must fit into an 11×9 matrix, no dot can overlap another, and either the top or the bottom row must be empty. Look at the enlargements of the characters in Chapter 3.

Designing Process

Suppose you want to print the scientific symbol for the planet Mercury. Although the LX-86 has a number of special symbols, that is not one of them You can, however, create and print such a symbol with ease. First, use a grid like the one in Figure 8-1 to plan where to place the dots.

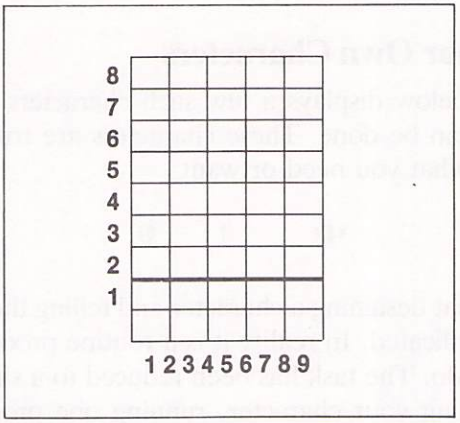


Figure 8-1. Grid for designing draft characters

Because the last two columns are reserved for the space between characters, they have not been included in the grid. And since most characters do not use the bottom two rows, a heavy line has been used to indicate the usual lower limit for an LX-86 character.

In placing dots on the grid you should remember that you are building up columns of dots to be printed as the head moves across the paper. When you place dots on this grid, remember that dots cannot go on horizontal lines, but they can go on vertical lines so long as they do not overlap any other dots. As you design your characters, draw the dots as large as you see them in the example on the left in Figure 8-2. If you draw them smaller, you may have overlapping dots without realizing it.

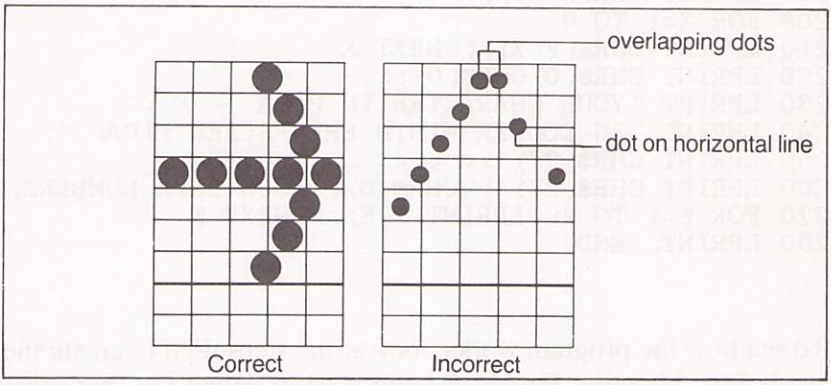


Figure 8-2. Correct and incorrect designs

It does not matter if you do accidentally make some of the dots overlapping. The program will still work, but only one of the dots will be printed.

First definition program

Once you have drawn your dots on the grid, type in the following BASIC program and run it.

```
100 DIM F(9)
110 FOR I=1 TO 9
120 PRINT "WHICH ROWS HAVE DOTS IN COLUMN";I
130 INPUT R: IF R=0 THEN 150
140 F(I)=F(I)+2^(R-1)
150 IF R=0 THEN NEXT I ELSE GOTO 130
160 LPRINT CHR$(27)":"CHR$(0)CHR$(0)CHR$(0)
170 LPRINT CHR$(27)"%"CHR$(1)CHR$(0)
180 LPRINT CHR$(27)"&"CHR$(0)CHR$(60)CHR$(60);
190 LPRINT CHR$(128);
200 FOR X=1 TO 9
210 LPRINT CHR$(F(X));:NEXT X
220 LPRINT CHR$(0)CHR$(0);
230 LPRINT "YOUR CHARACTER IN PICA: < < <"
240 LPRINT "IN DOUBLE-WIDTH EMPHASIZED PICA: ";
250 LPRINT CHR$(27)"!< < <"
260 LPRINT CHR$(27)"!"CHR$(0);"YOUR DATA NUMBERS;"
270 FOR K=1 TO 9: LPRINT F(K);: NEXT K
280 LPRINT: END
```

To see how the program works, look at the steps used to create the symbol for Mercury. First is the grid used to design the character.

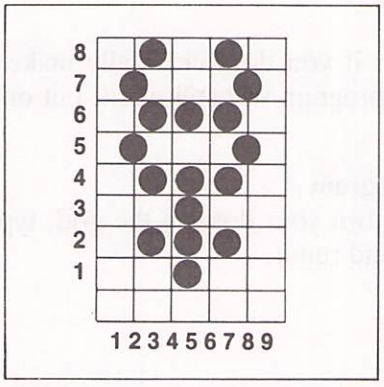


Figure 8-3. Design for character

Running the program

Now run the program. For each of the nine columns, the program asks for the numbers of the rows in which you want dots to appear. Enter the row numbers one at a time, pressing the **RETURN** key after each one. When you have entered all the numbers for a column or when you want no dots in a column, press **RETURN** without a number. Remember that the vertical lines in the grid are the even-numbered columns.

To see the program produce the character in Figure 8-3, run the program and follow these instructions: When the screen message asks what rows have dots in the column 1, respond with **RETURN** to indicate that no dots go in that column. For column 2 (the vertical line), press 7, **RETURN**, 5, and **RETURN** again to indicate that you want dots in rows 7 and 5. Then press **RETURN** alone to indicate that no more dots go in column 2. For column 3, press 8, 6, 4, and 2, with a **RETURN** after each of them. Then press **RETURN** to finish with column 3 and go to column 4.

For column 4 press **RETURN** only. (The rest of the directions assume that you know to press **RETURN** after each number and one extra time to end the entries for each column.) For column 5 enter 6, 4, 3, 2, and 1. For column 6 enter 7 and 5; and for column 9 press **RETURN** only.

Now wait a moment for your computer to calculate the dot patterns and the printer to print the new character in two different typestyles. Your printout also gives you nine numbers, which you will use in the next program. You should get the printout you see below.

```
YOUR CHARACTER IN PICA: ¥ ¥ ¥
IN DOUBLE-WIDTH EMPHASIZED PICA:    ¥¥   ¥¥
YOUR DATA NUMBERS;
  0   80   170   0   47   0   170   80   0
```

When you get to this point with a character of your own, you see how it looks and whether or not you like it. If you want to make any changes, move the dots as needed and re-run the program.

If you want to put dots in the bottom row, change the number in line 190 from 128 to 0. Then the usable rows will be as shown in Figure 8-4 below.

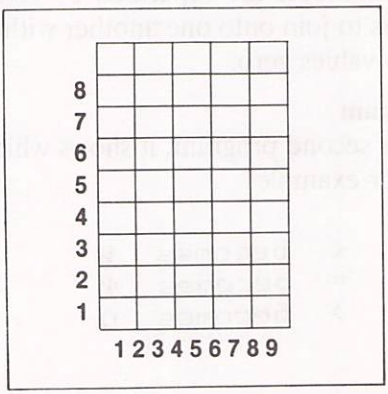


Figure 8-4. Using the bottom eight rows

Second definition program

Once the character looks the way you want it to, enter, modify, and run the next program. The program as listed creates the Mercury character, and two others. You can use it to redefine any of the possible six characters : ; < = > and ? by adding more data statements as will be explained later.

```
100 LPRINT CHR$(27);"x";CHR$(0);
110 LPRINT CHR$(27);":";CHR$(0);CHR$(0);CHR$(0);
120 LPRINT CHR$(27);"%";CHR$(1);CHR$(0);
130 READ A$
140 IF A$="XX" THEN END
150 LPRINT CHR$(27);"&";CHR$(0);A$;A$;CHR$(128);
160 FOR K=1 TO 11
170 READ F:LPRINT CHR$(F);
180 NEXT K
190 REM Display characters
200 LPRINT CHR$(27);"%";CHR$(0);CHR$(0);
210 LPRINT  A$;"  becomes  ";
220 LPRINT CHR$(27);"%";CHR$(1);CHR$(0);
230 LPRINT A$
240 GOTO 130
250 DATA "<",0,80,170,0,47,0,170,80,0,0,0
260 DATA "=",112,8,0,138,116,138,0,8,112,0,0
270 DATA ">",58,68,2,128,0,128,2,68,58,0,0
280 DATA "XX"
```

This program works in a similar way to the previous program, but instead of inputting the data from the keyboard, the data is embedded in the program as data statements. You can use the previous program to design the characters and when you have it correct, make a permanent program with this one. The program has been written to allow you to add them without making any other changes. However, you must put the new lines before line 280.

Check your work by making sure that there are 11 numbers in each line and that the numbers are separated by commas. Unless you want the characters to join onto one another without spaces, always make the last two values zero.

Running the program

When you run this second program, it shows which characters have been redefined, for example:

```
<  becomes  ♀
=  becomes  Ψ
>  becomes  Ω
```

The new characters will be stored in the memory of the LX-86 until the printer is switched off, or receives the reset code. You can switch between the ROM characters and the defined ones by using the <ESC> % code.

If you have designed a few characters and want to use them with a word processing program, for example, just run the second definition program before you start using the word processing program. Then use the printout as your guide to which keys to press for your new characters.

Defining NLQ Characters

Since NLQ characters use many more dots than draft characters, defining NLQ characters is more complex than designing draft ones. If you use the grid and the programs in this section, however, you should find it easy to do.

NLQ grid

Because the NLQ characters can use as many as 18 dots vertically and 12 dots horizontally, you plan your designs on a different grid to the one you used for draft characters.

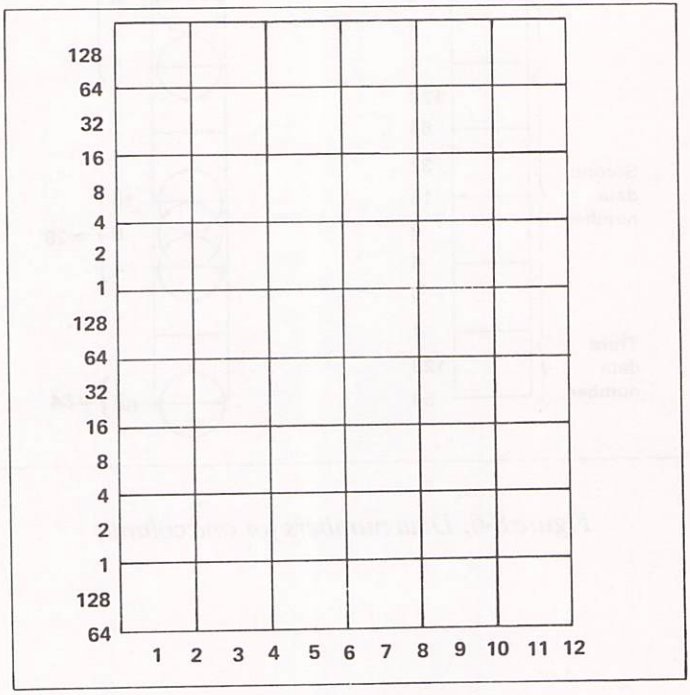


Figure 8-5. Grid for NLQ characters

On this grid you can use any numbered line or space. As you can see, that includes the bottom line and the line on the right side. You should remember to leave one or two columns blank for space between characters, however.

Each NLQ character definition requires 36 data numbers. Therefore, each vertical column must be divided into three sections for the calculation of data numbers. The process is not difficult once you practice using it.

Figure 8-6 shows a single column to make it clear how the data numbers are calculated. In designing NLQ characters you should use circles instead of dots to make it easier to keep track of overlapping dots.

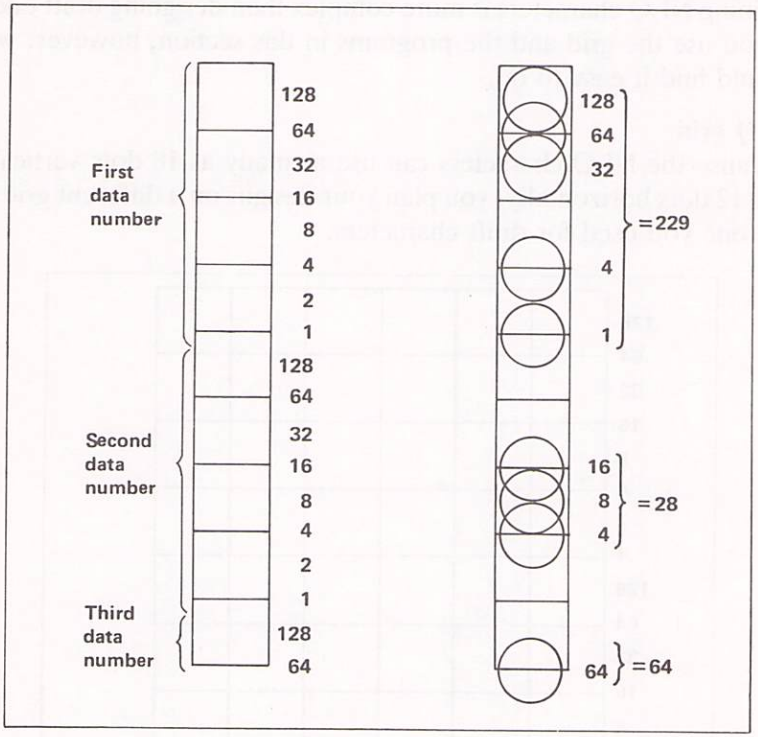


Figure 8-6. Data numbers for one column

To calculate the data numbers for this column, you will need to find three different numbers. First find out which dots are used in the top group (the top eight positions) and add their values together. Then you go down to the middle group (the next eight positions) and add the values of any dots that are used there. Finally, look at the bottom group (two dot positions) and add together the values used there.

If no dots are used in a group, the data number for that group is zero. All zeros must be entered in the DATA statements for the NLQ definition programs.

Now as an example the previous program will be modified to produce an arrow in NLQ mode. Figure 8-7 shows the design drawn on a grid and the data numbers printed at the top or bottom of each column.

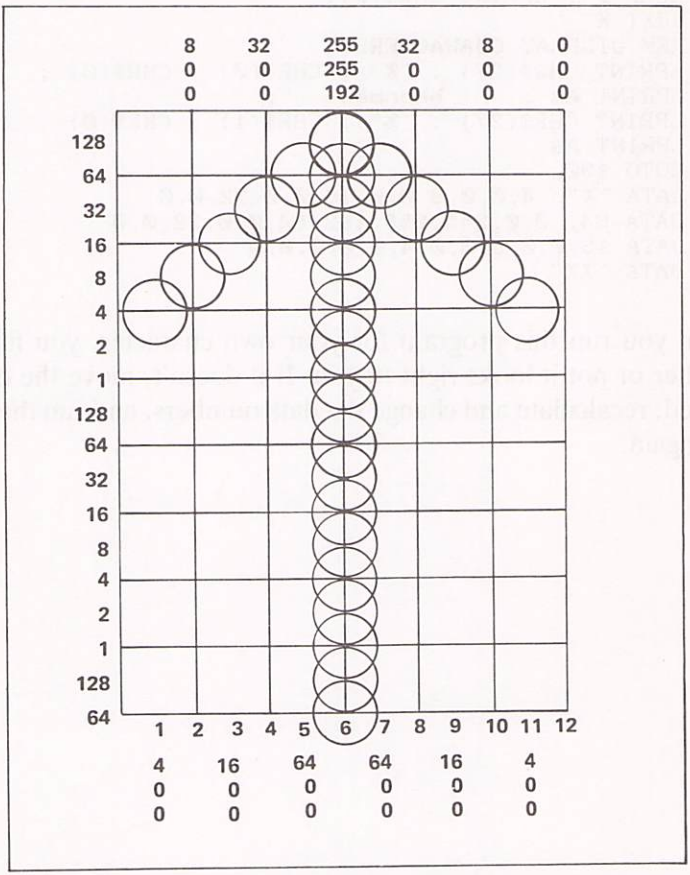


Figure 8-7. Arrow design and data numbers

If you look at each column individually, you can see how the data numbers were calculated.

NLQ definition program

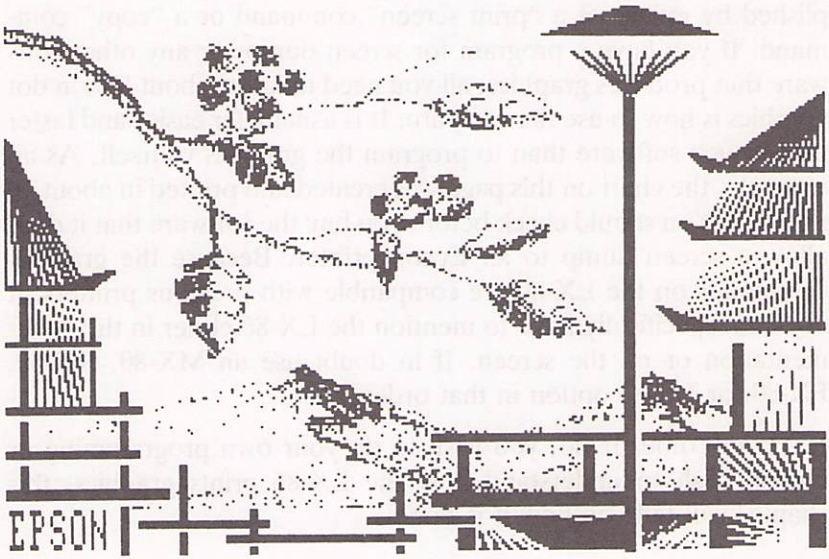
Now type in and run the following program. It has the data numbers for the arrow design. For a character of your own, change the data numbers in lines 250 –270 or you can add up to six characters with more data statements as in the previous program. Again you must put all your data before statement in line 280.

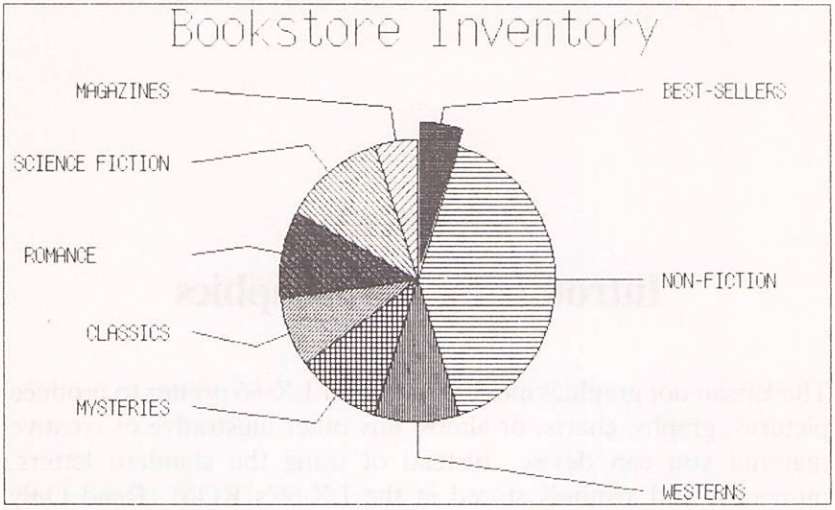
```
100 LPRINT CHR$(27) ; "x" ; CHR$(1) ;
110 LPRINT CHR$(27) ; ":" ; CHR$(0) ; CHR$(0) ; CHR$(0);
120 LPRINT CHR$(27) ; "%" ; CHR$(1) ; CHR$(0) ;
130 READ A$
140 IF A$ = "XX" THEN END
150 LPRINT CHR$(27) ; "&" ; CHR$(0); A$; A$;
155 LPRINT CHR$(0) ; CHR$(12); CHR$(0);
160 FOR K = 1 TO 36
170 READ F : LPRINT CHR$(F);
180 NEXT K
190 REM DISPLAY CHARACTERS
200 LPRINT CHR$(27) ; "%" ; CHR$(0) ; CHR$(0) ;
210 LPRINT A$ ; "    becomes    ";
220 LPRINT CHR$(27) ; "%" ; CHR$(1) ; CHR$(0) ;
230 LPRINT A$
240 GOTO 130
250 DATA "<", 4,0,0,8,0,0,16,0,0,32,0,0
260 DATA 64, 0,0,255,255,192,64,0,0,32,0,0
270 DATA 16,0,0,8,0,0,4,0,0,0,0,0
280 DATA "XX"
```

When you run this program for your own character, you find out whether or not it looks right to you. If it doesn't, move the dots as needed, recalculate and change the data numbers, and run the program again.

Chapter 9
Introducing Dot Graphics

The Epson dot graphics mode allows your LX-86 printer to produce pictures, graphs, charts, or almost any other illustrative or creative material you can devise. Instead of using the standard letters, numerals, and symbols stored in the LX-86's ROM (Read Only Memory), the graphics mode prints columns of dots on a line and the picture is built up from the dots. For large pictures more than one line will be necessary.





In many cases you may wish to use commercial programs to design graphics on a screen. Most of these programs perform what is called a screen dump, in which whatever is on the computer screen is sent to, and printed by, the printer. This function is sometimes accomplished by means of a "print screen" command or a "copy" command. If you have a program for screen dumps or any other software that produces graphics, all you need to know about Epson dot graphics is how to use the software. It is usually far easier and faster to use such software than to program the graphics yourself. As an example, the chart on this page was created and printed in about 10 minutes. You should check before you buy the software that it does allow a screen dump to an Epson printer. Because the graphics commands on the LX-86 are compatible with previous printers, it does not specifically have to mention the LX-86 either in the documentation or on the screen. If in doubt use an MX-80, RX-80, FX-80, or LX-80 option in that order.

If, on the other hand, you wish to do your own programming or merely wish to understand how the LX-86 prints graphics, this chapter will tell you how it is done.

Dot Patterns

The LX-86 forms graphic images approximately the same way that pictures in newspapers and magazines are printed. If you look closely at a newspaper photograph, you can see that it is made up of many small dots. The LX-86 also forms its images with patterns of dots. In designing the graphics on the printer, you have to use a

program to decide which dots are filled in and which are left blank. It is often better to use squared graph paper to make up the design, and then transfer the dot pattern to the program. In order to do this it is necessary to understand how the print head transfers the dots to the paper.

Print Head

The graphics mode on the LX-86 is quite different from the text modes. Instead of sending codes for letters and printing functions, the codes you send are ones that print a pattern of dots in a column. None of the predefined characters or symbols in the printer's memory is used. Your program controls exactly where each dot is printed, column by column and line by line.

The columns are defined by the row of pins on the print head. In the standard graphics mode it uses only the top eight pins on the print head because the computer uses eight data lines to communicate with the printer. Each of the top eight pins of the print head corresponds to one of the data lines. There is also a graphics mode which allows all nine pins of the head to be used.

When you want to print figures more than eight dots high, it is necessary to print on a new line, advancing the paper and printing another line, just as you would with text. To keep the print head from leaving gaps between the graphics lines as it does between the text lines, the line spacing must be adjusted to eliminate this gap. When the line spacing is properly adjusted, the LX-86 prints finely detailed graphics images that give no indication that they are made up of separate lines, each no more than 1/8 of an inch high.

To ensure the proper alignment of dots in figures that use more than one line, the LX-86 abandons the bidirectional printing it uses for draft text. Instead it prints from left to right only in graphics mode.

It is not necessary to fill the whole page or even an entire line with your graphics figures. However, before you send the data corresponding to the columns of the pattern, you must tell the printer how much data to expect. This information is part of the graphics command.

Graphics Mode

The graphics mode command is quite different from the other commands covered so far in this manual. For most of the other LX-86 modes, such as italic and emphasized, one <ESC> code turns the mode on and another turns it off. With graphics, the commands are more complicated because the code that turns on a graphics mode also specifies how many columns it will use.

The LX-86 has several different graphics densities. Initially, to keep things simple, only one will be described. Once you have mastered this the others will be straightforward. This graphics mode is called single density mode and its <ESC> code is:

<ESC> K n1 n2.

The values of n1 and n2 are a sequence of two ASCII codes which determine the number of columns of graphics data to be printed on a line. You can calculate the values of n1 and n2 from the number of columns n as follows:

n1 = remainder on dividing n by 256
n2 = the integer (i.e. the whole number) part of the division of n by 256

In Microsoft BASIC these values would be obtained from the expressions:

n1 = n MOD 256
n2 = INT (n/256)

Some versions of BASIC do not have the MOD function. In this case, the expressions used will be:

n1 = n - n2 * 256
n2 = INT (n/256)

Since calculation of n1 requires the value of n2, you will have to calculate n2 first.

When you have carried out the calculation, you can then use the following line in a Microsoft BASIC program:

```
LPRINT CHR$(27)"K"CHR$(N1)CHR$(N2);
```

The number of columns reserved is the first number plus 256 times the second number. Since the command is set up for two numbers, you must supply two even if you only need one. When you need less than 256 columns, just make n1 the number of columns you are reserving and make n2 a zero.

If you are a simply trying to use the command to produce graphics, and are not concerned with the technicalities, you can move on to the next section to learn how to define the codes for producing the patterns. For the more advanced programmer, the graphics command requires more than one number to specify how many columns to reserve because as many as 1920 columns are possible in graphics printing. Since the LX-86 uses 8-digit binary numbers, it cannot accept decimal numbers larger than 255. The number of columns has to be split into a 16-bit number, with the low byte sent after the command and then the high byte.

Pin Numbering

Once you have put the printer into graphics mode and reserved the number of columns you want, your next step is to tell the print head which pins to fire in each column. There are 256 possible combinations of eight pins. Sending one number prints one column. The number is sent as an ASCII code. The numbering system for specifying a particular one of the 256 patterns you want is shown in Figure 9-1.

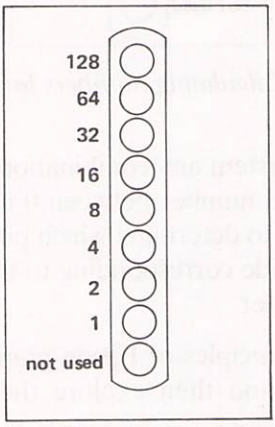


Figure 9-1. Pin numbering

If you only want to fire one pin, send the ASCII code corresponding to its number. To fire more than one pin at the same time, add up the numbers corresponding to the pins you wish to fire and send the ASCII code of the sum to the printer. For example if you want to fire just the top pin send ASCII code 128. To fire just the bottom pin send ASCII code 1. To fire both the top and bottom pin in the same column, send ASCII code 129.

By adding the appropriate numbers together, you can fire any combination of pins. Figure 9-2 shows you three examples of how to calculate the number that will fire a particular pattern of pins.

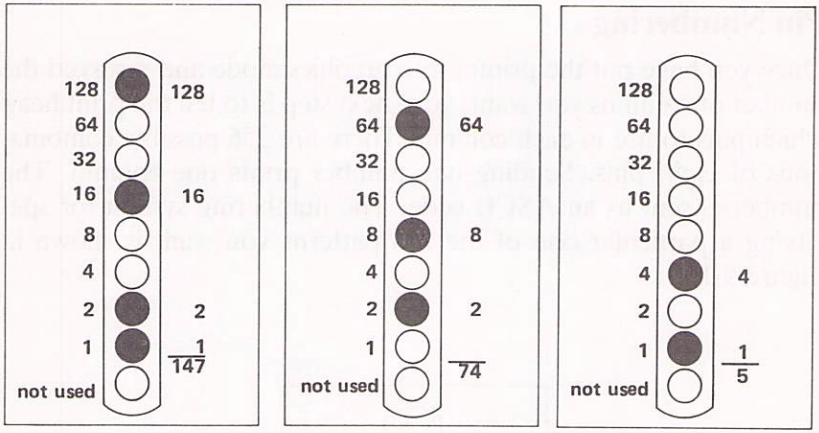


Figure 9-2. Calculating numbers for pin patterns

With this numbering system any combination of the eight pins adds up to a unique decimal number between 0 and 255. Although you use a decimal number, to determine which pins are to be fired, since you send the ASCII code corresponding to the number, the printer receives a binary number.

Having covered the principles of Epson graphics, it is time to produce some programs and then explore the more complex commands.

First Graphics Program

Rather than produce a complex line of graphics the first graphics program prints the same pattern 40 times. In this way you can see a clear result from inputting code to one column whereas just printing one column would require a microscope to determine whether the pattern was correct.

The first line is the code for 40 columns of single-density graphics. As usual, the example is in Microsoft BASIC.

```
1Ø LPRINT CHR$(27)"K"CHR$(4Ø)CHR$(Ø);
```

The second line is the data that fires the pins. Note how it has been derived from the pattern in the middle diagram of Figure 9-2. It simply prints the data 40 times.

```
2Ø FOR X=1 TO 4Ø: LPRINT CHR$(74);: NEXT X
```

The data must be received by the printer as a continuous set with no intervening carriage returns or line feeds. So be extra careful that the semi-colons are present in both lines.

It is a simple program and the result is:

Although it is not as interesting or as complex as the examples at the beginning of this chapter, it does allow you to see exactly how the mode works.

Multiple-Line Exercise

Having found out how to enter and run a simple graphics program, the next exercise shows how the LX-86 combines several lines of graphics for a figure taller than eight dots.

Start with a line for 100 columns of single-density graphics and lines to print two pin patterns. Notice that since there are two pin patterns in the loop, it is only executed 50 times.

```
30 LPRINT CHR$(27)"K"CHR$(100)CHR$(0);
40 FOR X=1 TO 50: LPRINT CHR$(85)CHR$(42);
50 NEXT X
```

If you run the program now, you will see how one line of the pattern looks:

To see how more than one line combines to form a figure, enter and run the following program, which uses two of the lines you have already typed and adds several more.

```
10 LPRINT CHR$(27)"1";
20 FOR R=1 TO 3
30 LPRINT CHR$(27)"K"CHR$(100)CHR$(0);
40 FOR X=1 TO 50: LPRINT CHR$(85)CHR$(42);
50 NEXT X: LPRINT
60 LPRINT CHR$(27)"K"CHR$(100)CHR$(0);
70 FOR X=1 TO 50: LPRINT CHR$(42)CHR$(85);
80 NEXT X: LPRINT: NEXT R
90 LPRINT CHR$(27)"@"
```

Now run the program to see the six print lines combine into a pattern:

The short and simple program that produced the pattern demonstrates many elements of graphics programming. In order to point these out it is necessary to break the program down into steps.

Line 10 changes to a 7-dot line spacing, which is the height of the dot patterns used in the program, thereby removing the space between the print lines.

Line 20 begins a loop to produce multiple print lines. Lines 30 and 40 are the same as above, but an LPRINT is added to line 50 to produce a line feed after line 40. Lines 60 and 70 are like lines 30 and 40 except that line 70 uses a reversal of the patterns in line 40. As the loop is executed, the program prints lines 40 and 70 alternately so that the patterns of the print lines will fit together well.

Notice that the graphics command can be in effect for only one print line. The command is in lines 30 and 60 so that it is issued each time a new print line is begun. You cannot print more than one line of graphics without having the graphics command issued each time.

Line 90 is the reset code to return the printer to its defaults.

Density Varieties

Although all the examples so far in this chapter have been in the single-density graphics mode, the LX-86 offers five other eight-pin density modes and two nine-pin ones. Nine-pin graphics is not necessary for most uses, but you can find its command (<ESC> Λ) in Appendix C. All the eight-pin densities and their commands are described in Table 9-1.

Table 9-1. Graphics modes

Mode	Density	Alternate code	Description
0	Single	ESC "K"	60 dots/inch: 480 dots/8" line
1	Low-Speed Double	ESC "L"	120 dots/inch 960 dots/8 line
2	High-Speed Double	ESC "Y"	120 dot positions/inch Faster than Mode 1; does not print consecutive dots in a row.
3	Quadruple	ESC "Z"	240 dot positions/inch; 1920 dot positions/8" line. Does not print consecutive dots in a row.
4	CRT	none	80 dots/inch; 640 dots/8" line
5	One-to-one (plotter)	none	72 dots/inch; 576 dots/8" line Produces the same density horizontally as vertically, which makes circles look round.
6	90 dots/inch	none	90 dots/inch 720 dots/8" line

You are familiar with the command format that uses the <ESC> code and a letter, but LX-86 graphics commands can also be in the following format:

```
LPRINT CHR$(27)"*"CHR$(M)CHR$(N1)CHR$(N2);
```

with m being the mode number found in the left column of Table 9-1. As usual, n1 and n2 reserve the number of columns for graphics. The seven modes include six densities, with two speeds for double-density.

Reassigning Codes

The LX-86 has a graphics command that changes one graphics mode to another. You can use it with many commercial graphics software programs to change the density and shape of your printouts. The code is <ESC> ?s n, where s is one of the four alternate graphics codes (K, L, Y, or Z) and n is the number of the new code (0–6).

For example, if you send the following code before you run a graphics program, it will change every instance of mode "Y" (high-speed double-density) to mode 5 (one-to-one).

```
LPRINT CHR$(27)"?Y"CHR$(5);
```

As usual, this example is in Microsoft BASIC, but you can send the code in any programming language.

Even if you don't know which code your graphics program uses, a little experimentation should tell you whether the reassigning code can improve your graphics printouts.

WIDTH Statements

Many computer systems automatically insert the control codes for a carriage return and a line feed after every 80 characters. This insertion is usually no problem with text, but it can spoil your graphics. In the graphics mode they may insert the control codes as extra characters, which could be in the middle of a line.

You can usually prevent these unwanted control codes with a WIDTH statement such as the one below:

```
WIDTH LPRINT 255
```

The format for your system may be different. Consult your computer or computer language manual to find the correct format. Then put a WIDTH statement in one of the first lines of all your graphics programs. It is easier to put a WIDTH statement in all but the simplest of your programs than to examine each one to see whether or not such a statement is necessary.

Design Your Own Graphics

This section describes the development of a graphics program. The example is not especially complicated, but it does include the same steps you would use for a more complex figure so that you have the basis for designing graphics on your LX-86.

Plan your figure with dots on graph paper but, before beginning to place the dots, you should decide which graphics density you want. Figure 9-3 shows the differences between the three most-used graphics modes so that you can choose the one you want.

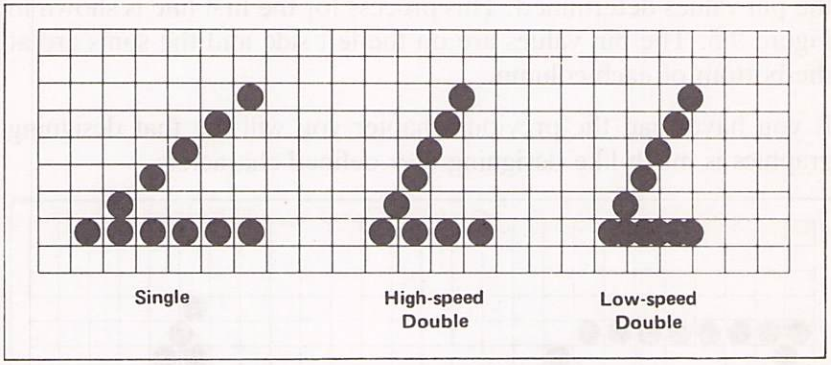


Figure 9-3. Designing in different densities

In this figure you can see the main rules for graphics design in the three densities. In single density, no dots can be placed on vertical lines. In high-speed double density dots can be placed on vertical lines but no dots can overlap. In low-speed double density, dots can be placed on vertical lines and they can overlap.

Now look at the figure designed for high-speed double density. It should point you in the right direction for your own designs.

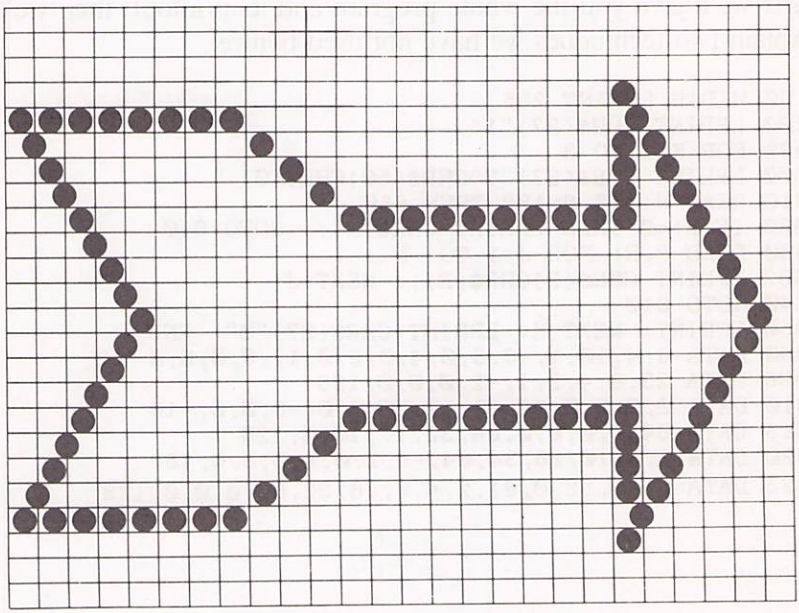


Figure 9-4. Arrow design

After plotting all the dots as in Figure 9-4, calculate the numbers for each pin pattern by dividing the design grid into separate print lines. For the arrow design the grid was divided into three lines, each seven dots high. Then each column was examined and the sums of the pin values determined. This process for the first line is shown in Figure 9-5. The pin values are on the left side and the sums are at the bottom of each column.

If you have read the previous chapter you will see that designing graphics is much like designing user-defined characters.

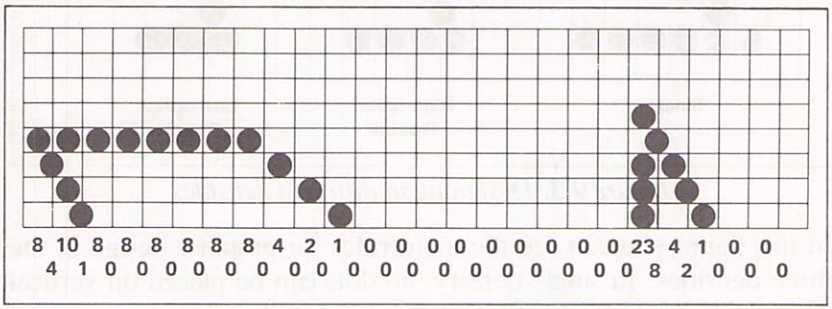


Figure 9-5. First line of arrow figure

The numbers for the second and third lines were calculated in the same manner. Once the numbers for the pin patterns are calculated, they go in DATA statements, separated by commas.

First we'll give you the whole program and its printout; then we'll explain two techniques we have not used before:

```
 90 WIDTH LPRINT 255
100 LPRINT CHR$(27)"1"
590 FOR K=1 TO 3
600 LPRINT CHR$(27)"Y"CHR$(50)CHR$(0);
610 READ N: IF N=128 THEN 650
620 IF N>=0 THEN LPRINT CHR$(N);: GOTO 610
630 READ P,R: FOR J=1 TO -N
632 LPRINT CHR$(P)CHR$(R);: NEXT J
640 GOTO 610
650 LPRINT: NEXT K: LPRINT CHR$(27)"@": END
800 DATA 8,4,10,1,-6,8,0,4,0,2,0,1,-9,0,0,0
805 DATA 23,8,4,2,1,-2,0,0,0,128
810 DATA 0,0,0,0,64,32,17,10,4,0,-6,0,0,-10
815 DATA 64,0,0,0,0,64,32,17,10,4,128
820 DATA 2,4,10,16,34,64,-5,2,0,4,0,8,0,16
825 DATA 0,-9,32,0,61,2,4,8,16,32,64,0,0,0,128
```

In this program we used the number 128 in the DATA statements to signal the end of a print line. This is the reason for the IF-THEN statement in line 610 that skips to line 650 and causes a line feed.

The other special technique used in this program is found in lines 620 and 630. Since some of the data numbers are repeated many times, negative DATA numbers have been used for repetitions, in order to save typing. Line 620 tests for a negative number and, if it finds one, reads the next two numbers and prints their pin patterns the number of times indicated by the negative number.

For example, when the minus 6 in line 800 is read, the program then reads the next two numbers (8 and 0) and sends them to the printer six times. This feature is not a necessary part of the program, but it does allow you to type fewer data numbers.

Otherwise, the program is a straightforward graphics program that uses 7-dot line spacing and reads numbers from DATA statements and sends them to the printer. If you want to see the figure in other densities, change the "Y" in line 600 to "L" or "Z".

Graphics Programming Tips

Now that we've shown you how to design your own graphics, we'll review and emphasize a few elements of graphics programming. As usual, Microsoft BASIC has been used in the examples, but the principles apply to any programming language although there may be other ways than using a semi-colon to prevent carriage returns and line feeds being added at the end of a statement.

Semicolons and command placement

After the graphics command is issued, every number sent to the LX-86 is interpreted as a pin pattern and printed on paper. Therefore, you must be careful how you write graphics commands in your program.

For example, suppose you want a 50-column graphics line with a 7-dot line spacing. You might enter the following program:

```
2Ø LPRINT CHR$(27)"K"CHR$(5Ø)CHR$(Ø)
3Ø LPRINT CHR$(27)"1"
4Ø FOR G=1 TO 5Ø: LPRINT CHR$(74): NEXT G
```

This program has all the necessary elements. Line 20 has the command for single-density graphics and specifies 50 columns. (Remember that you must use two numbers to reserve columns even if you only need the first one.) Line 30 has the correct command for the line spacing, and line 40 calls for the printing of a pin pattern 50 times. (If you wish, refer back to Figure 9-2 to see a representation of the pin pattern that 74 produces.)

Although this program has all the necessary elements, it will not give you the single pin pattern that you want, as you can see in the partial printout in Figure 9-6.

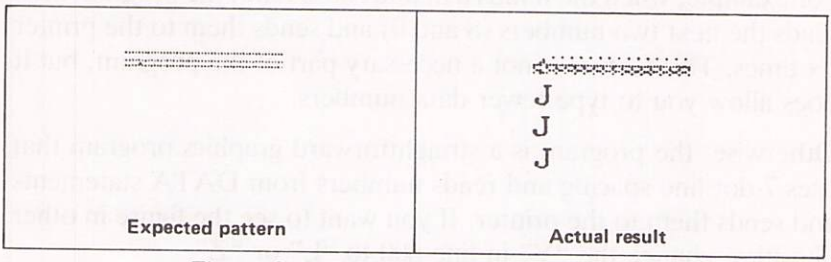


Figure 9-6. Result of incorrect program

What went wrong? To help you understand the graphics command and avoid some of the more common errors made with it, let us examine this program in detail.

First look at line 20. <ESC> K calls for single-density graphics, and the two CHR$ numbers specify 50 columns of dots. Once that command is given, the next 50 codes sent to the printer are interpreted as numbers corresponding to a pin pattern and printed on the paper. Since there is no semi-colon at the end of the line, the numbers 13 and 10—the codes for carriage return and line feed—are sent to the printer after CHR$(0). Because the graphics command has been issued, these codes are printed as pin patterns.

Line 30 would normally be the command for 7-dot line spacing, but since the graphics mode has been put into effect, the command is interpreted by the printer as two pin patterns: 27 and 49 (the ASCII codes for <ESC> and 1). Since there is no semi-colon at the end of this line, the numbers 13 and 10 are sent again, and again they are printed as pin patterns.

In line 40 nothing is sent to the printer until after the LPRINT. Then the desired pin pattern—74—is finally sent, but since no semicolon is after it, 13 and 10 are sent next each time the loop is executed.

Figure 9-7 is an enlarged representation of the first 14 columns of the printout. In this figure you can see exactly how the printer reacted to the first part of the incorrect program.

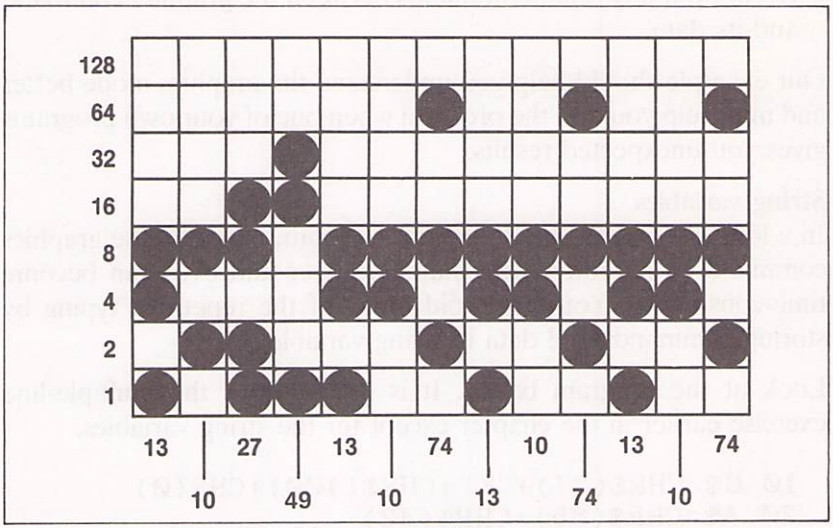


Figure 9-7. Pin patterns of incorrect program

You may also wonder why the program prints not only the different pin patterns but also the character "J" a number of times. The reason lies in the number of columns you reserved with the graphics command. After the LX-86 receives all the numbers reserved by a graphics command—50 in this case—it leaves the graphics mode and resumes interpreting numbers as printable characters or print commands.

Since the incorrect program has sent many extra numbers, mainly 10s and 13s, the 50 columns reserved are filled before the loop in line 40 has been executed 50 times. Therefore, during the last passes of the loop the LX-86 interprets CHR$(74) as the ASCII code for "J" and prints that character each of the last 35 passes of the loop.

If you want to make the program work correctly, put the line-spacing command in line 10, delete line 30 and add two semi-colons: one at the end of line 20 and one between CHR$(74) and the colon in line 40.

This incorrect program has been explained in detail so that you will remember two important tips about using the graphics command:

- Use semi-colons to prevent the LX-86 from printing carriage return and line feed codes as pin patterns in BASIC programs, and take similar steps in other programming languages.
- Do not put any other commands between the graphics command and its data.

Our example should help you understand the graphics mode better and may help you find the problem when one of your own programs gives you unexpected results.

String variables

In a long and complicated graphics program, typing in the graphics command or repetitive data numbers over and over can become time-consuming. You can avoid much of the repetitive typing by storing commands and data in string variables.

Look at the program below. It is the same as the multiple-line exercise earlier in the chapter except for the string variables.

```
 10 G$=CHR$(27)+"K"+CHR$(100)+CHR(0)
 20 A$=CHR$(85)+CHR$(42)
 30 B$=CHR$(42)+CHR$(85)
 40 LPRINT CHR$(27)"1";
 50 FOR R=1 TO 3
 60 LPRINT G$;
 70 FOR X=1 TO 50: LPRINT A$;: NEXT X
 80 LPRINT
 90 LPRINT G$;
100 FOR X=1 TO 50: LPRINT B$;: NEXT X
110 LPRINT: NEXT R
120 LPRINT CHR$(27)"@"
```

Notice that the first line stores the whole graphics command in a single string variable. In order to do this you must put plus signs between the elements of the command. Once you have done this at the beginning of the program, each time you enter LPRINT G$; you have issued the graphics command. Lines 20 and 30 do the same thing with the data used in this program. As you can see, the use of string variables saves some typing even in this short program. In a long program it can save you much more time and effort.

Graphics and low ASCII codes

Sending a few of the codes between 0 and 31 with BASIC or another programming language can cause problems on some computer systems. The problem is that most computer systems handle some of these codes in a special way instead of delivering them to the printer.

For example, one computer system handles form feeds by itself. It counts lines to keep track of the top of page. If a program sends the ASCII code for form feed (12) to the printer, the computer system intercepts it and sends instead the code for line feed (10) several times. If you are in a graphics mode with this system and send a 12 to fire pins 3 and 4, the computer system will intercept that 12 and send several 10s instead. You can see how this would ruin your graphics. You would get pins 2 and 4 (whose sum is 10) several times instead of pins 3 and 4 only once.

If your computer system removes or changes any codes sent to it, you can often design around these problems by using other numbers with similar patterns, and you can see Appendix F for a method to determine which codes may cause problems and for some ideas on overcoming those problems.

Appendix A
ASCII Codes and Character Sets

In Chapter 6, you saw how to make the LX-86 print out a large assortment of international and graphic characters. This appendix provides additional information on the various character and graphic sets that are available with the printer.

ASCII Character Set

On the following page, a table presents the standard ASCII code character set and the alternate character/graphic set explained later in this appendix. The codes are shown both as decimal (dec) and hexadecimal (hex) values. As explained in Chapter 6, when you send the <ESC> code and a decimal value to the printer, the corresponding character or graphic symbol is printed.

Dec	Hex	Standard	Graphic	Dec	Hex	Standard	Graphic	Dec	Hex	Standard	Graphic
0	00	NUL	NUL	43	2B	+	+	86	56	V	V
1	01			44	2C	,	,	87	57	W	W
2	02			45	2D	-	-	88	58	X	X
3	03			46	2E	.	.	89	59	Y	Y
4	04			47	2F	/	/	90	5A	Z	Z
5	05			48	30	0	0	91	5B	[	[
6	06			49	31	1	1	92	5C	\	\
7	07	BEL	BEL	50	32	2	2	93	5D	]	]
8	08	BS	BS	51	33	3	3	94	5E	^	^
9	09	HT	HT	52	34	4	4	95	5F	_	_
10	0A	LF	LF	53	35	5	5	96	60	`	`
11	0B	VT	VT	54	36	6	6	97	61	a	a
12	0C	FF	FF	55	37	7	7	98	62	b	b
13	0D	CR	CR	56	38	8	8	99	63	c	c
14	0E	SO	SO	57	39	9	9	100	64	d	d
15	0F	SI	SI	58	3A	:	:	101	65	e	e
16	10			59	3B	;	;	102	66	f	f
17	11	DC1	DC1	60	3C	<	<	103	67	g	g
18	12	DC2	DC2	61	3D	=	=	104	68	h	h
19	13	DC3	DC3	62	3E	>	>	105	69	i	i
20	14	DC4	DC4	63	3F	?	?	106	6A	j	j
21	15			64	40	@	@	107	6B	k	k
22	16			65	41	A	A	108	6C	l	l
23	17			66	42	B	B	109	6D	m	m
24	18	CAN	CAN	67	43	C	C	110	6E	n	n
25	19	EM	EM	68	44	D	D	111	6F	o	o
26	1A			69	45	E	E	112	70	p	p
27	1B	ESC	ESC	70	46	F	F	113	71	q	q
28	1C			71	47	G	G	114	72	r	r
29	1D			72	48	H	H	115	73	s	s
30	1E			73	49	I	I	116	74	t	t
31	1F			74	4A	J	J	117	75	u	u
32	20	SP	SP	75	4B	K	K	118	76	v	v
33	21	!	!	76	4C	L	L	119	77	w	w
34	22	"	"	77	4D	M	M	120	78	x	x
35	23	#	#	78	4E	N	N	121	79	y	y
36	24	$	$	79	4F	O	O	122	7A	z	z
37	25	%	%	80	50	P	P	123	7B	{	{
38	26	&	&	81	51	Q	Q	124	7C	|	|
39	27	'	'	82	52	R	R	125	7D	}	}
40	28	(	(	83	53	S	S	126	7E	~	~
41	29	)	)	84	54	T	T	127	7F	DEL	DEL
42	2A	*	*	85	55	U	U				

Dec	Hex	Standard	Graphic	Dec	Hex	Standard	Graphic	Dec	Hex	Standard	Graphic
128	80		Ç	170	AA	*	¬	213	D5	U	╒
129	81		ü	171	AB	+	½	214	D6	V	╓
130	82		é	172	BC	,	¼	215	D7	W	╫
131	83		â	173	AD	-	¡	216	D8	X	╪
132	84		ä	174	AE	.	«	217	D9	Y	┘
133	85		à	175	AF	/	»	218	DA	Z	┌
134	86		å	176	B0	0	░	219	DB	[	█
135	87	BEL	ç	177	B1	1	▒	220	DC	\	▄
136	88	BS	ê	178	B2	2	▓	221	DD	]	▌
137	89	HT	ë	179	B3	3	│	222	DE	^	▐
138	8A	LF	è	180	B4	4	┤	223	DF	_	▀
139	8B	VT	ï	181	B5	5	╡	224	E0	`	α
140	8C	FF	î	182	B6	6	╢	225	E1	a	ß
141	8D	CR	ì	183	B7	7	╖	226	E2	b	Γ
142	8E	SO	Ä	184	B8	8	╕	227	E3	c	π
143	8F	SI	Å	185	B9	9	╣	228	E4	d	Σ
144	90		É	186	BA	:	║	229	E5	e	σ
145	91	DC1	æ	187	BB	;	╗	230	E6	f	µ
146	92	DC2	Æ	188	BC	<	╝	231	E7	g	τ
147	93	DC3	ô	189	BD	=	╜	232	E8	h	Φ
148	94	DC4	ö	190	BE	>	╛	233	E9	i	Θ
149	95		ò	191	BF	?	┐	234	EA	j	Ω
150	96		û	192	C0	@	└	235	EB	k	δ
151	97		ù	193	C1	A	┴	236	EC	l	∞
152	98	CAN	ÿ	194	C2	B	┬	237	ED	m	ø
153	99	EM	Ö	195	C3	C	├	238	EE	n	∈
154	9A		Ü	196	C4	D	─	239	EF	o	∩
155	9B	ESC	¢	197	C5	E	┼	240	F0	p	≡
156	9C		£	198	C6	F	╞	241	F1	q	±
157	9D		¥	199	C7	G	╟	242	F2	r	≥
158	9E		₧	200	C8	H	╚	243	F3	s	≤
159	9F		ƒ	201	C9	I	╔	244	F4	t	⌠
160	A0	SP	á	202	CA	J	╩	245	F5	u	⌡
161	A1	!	í	203	CB	K	╦	246	F6	v	÷
162	A2	"	ó	204	CC	L	╠	247	F7	w	≈
163	A3	#	ú	205	CD	M	═	248	F8	x	°
164	A4	$	ñ	206	CE	N	╬	249	F9	y	∙
165	A5	%	Ñ	207	CF	O	╧	250	FA	z	·
166	A6	&	ª	208	D0	P	╨	251	FB	{	√
167	A7	'	º	209	D1	Q	╤	252	FC	/	n
168	A8	(	¿	210	D2	R	╥	253	FD	}	2
169	A9	)	⌐	211	D3	S	╙	254	FE	~	■
				212	D4	T	╘	255	FF	DEL	SP

Control Codes Used by the LX-86

The following table shows which control codes are used by the LX-86. Codes in the range 128 to 155 mirror the function of their low-order counterparts, i.e. codes in the range 0 to 27.* In some cases it is necessary or more convenient to use the high-order codes instead of the low-order ones. For example, if your system will not send an ASCII code 9 for a horizontal tab, try sending ASCII code 137 instead. Both sets are listed here:

Low Dec	High Dec	High Hex	Symbol	Function
0			NUL	Terminates horizontal and vertical tab setting <ESC> sequence
7	135	87	BEL	Sounds beeper
8	136	88	BS	Backspace
9	137	89	HT	Horizontal tab
10	138	8A	LF	Line feed
11	139	8B	VT	Vertical tab
12	140	8C	FF	Form feed
13	141	8D	CR	Carriage return
14	142	8E	SO	Shift out; turns expanded mode ON
15	143	8F	SI	Shift in; turns condensed mode ON
18	146	92	DC2	Device control 2; turns condensed mode OFF
20	148	93	DC4	Device control 4; turns expanded mode set by ASCII 14 OFF
24	152	97	CAN	Cancels all text in print buffer
25	153	98	EM	Used with <ESC> code to enable/disable cut-sheet feeder
27	155	9B	ESC	<ESC> code

* As explained later in this appendix, when you send <ESC> 6 to the printer, the upper level control codes are instead used for international characters.

Control Key Chart

Some applications programs can use control key codes corresponding to decimal values 0–27. The table below shows which keys to hold down for which code. The Control key column indicates that you press the control key at the same time as you press the key for the letter or symbol in that column. For example, you press the control key and A at the same time to send the ASCII code 1.

Some programs that use this system cannot use Control-@, and many programs use the control keys for their own distinctly different purpose.

Decimal	Hexadecimal	Control key
0	00	@
1	01	A
2	02	B
3	03	C
4	04	D
5	05	E
6	06	F
7	07	G
8	08	H
9	09	I
10	0A	J
11	0B	K
12	0C	L
13	0D	M
14	0E	N
15	0F	O
16	10	P
17	11	Q
18	12	R
19	13	S
20	14	T
21	15	U
22	16	V
23	17	W
24	18	X
25	19	Y
26	1A	Z

Standard and Character/Graphic Sets

The LX-86 makes it possible to "customize" the ASCII set in several ways, depending on your particular printing requirements. One way is to change a portion of the standard set so that the upper control codes no longer duplicate the lower control codes but instead print the full set of international characters. Or, you can make it so that the LX-86 graphics table is compatible with the IBM set.

Standard character set

The table below shows the characters of the standard set which is the default setting when DIP switch 1-2 is set to OFF. (To make it easy to see the changes, the table is presented in a hexadecimal arrangement. How to convert from hexadecimal to decimal values is explained at the end of this appendix.)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL		SP	0	@	P	`	p			SP	0	@	P	`	p
1		DC1	!	1	A	Q	a	q		DC1	!	1	A	Q	a	q
2		DC2	"	2	B	R	b	r		DC2	"	2	B	R	b	r
3		DC3	#	3	C	S	c	s		DC3	#	3	C	S	c	s
4		DC4	$	4	D	T	d	t		DC4	$	4	D	T	d	t
5			%	5	E	U	e	u			%	5	E	U	e	u
6			&	6	F	V	f	v			&	6	F	V	f	v
7	BEL		'	7	G	W	g	w	BEL		'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y	HT	EM	)	9	I	Y	i	y
A	LF		*	:	J	Z	j	z	LF		*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{	VT	ESC	+	;	K	[	k	{
C	FF		,	<	L	\	l	|	FF		,	<	L	\	l	|
D	CR		-	=	M	]	m	}	CR		-	=	M	]	m	}
E	SO		.	>	N	^	n	~	SO		.	>	N	^	n	~
F	SI		/	?	O	_	o	DEL	SI		/	?	O	_	o	DEL

* The shaded area can be changed by <ESC> 6, <ESC> 7, or <ESC> m.

Figure A-1. Standard character set

The shaded area is the part of the table that can be changed by three different <ESC> commands.

The first two are <ESC> 6 and <ESC> 7. When you send <ESC> 6 to the printer the upper control codes are changed as shown below. Thereafter, codes from this area of the table print international characters. <ESC> 7 changes the table back to the upper control codes. (You can also either turn the printer off and then back on, or send it the reset code to make the upper control codes function again.)

The third <ESC> command is <ESC> m4. When this command is sent to the printer, the shaded area changes as shown below, giving you a selection of 32 additional graphic characters. These characters are compatible with Epson portable computers. (Note: This <ESC> command is valid only for the standard table, and may not be used in conjunction with <ESC> t1.) <ESC> m0 turns off the Epson character set, returning the printer to the previously selected code table. <ESC> 6 and <ESC> 7 are ignored while <ESC> m4 is in effect.

	8	9	F
0	NUL		
1		DC1	
2		DC2	
3		DC3	
4		DC4	
5			
6			
7	BEL		
8	BS	CAN	
9	HT	EM	
A	LF		
B	VT	ESC	
C	FF		
D	CR		
E	SO		
F	SI		DEL

Before change

	8	9	F
0	à	É	
1	è	ß	
2	ù	ñ	
3	ò	æ	
4	ì	ø	
5	°	¢	
6	£	¨	
7	/	Ä	
8	¿	Ö	
9	Ñ	Ü	
A	ñ	ä	
B	Ç	ö	
C	ñ	ü	
D	Å	é	
E	å	é	
F	ç	¥	Ø

After <ESC> 6

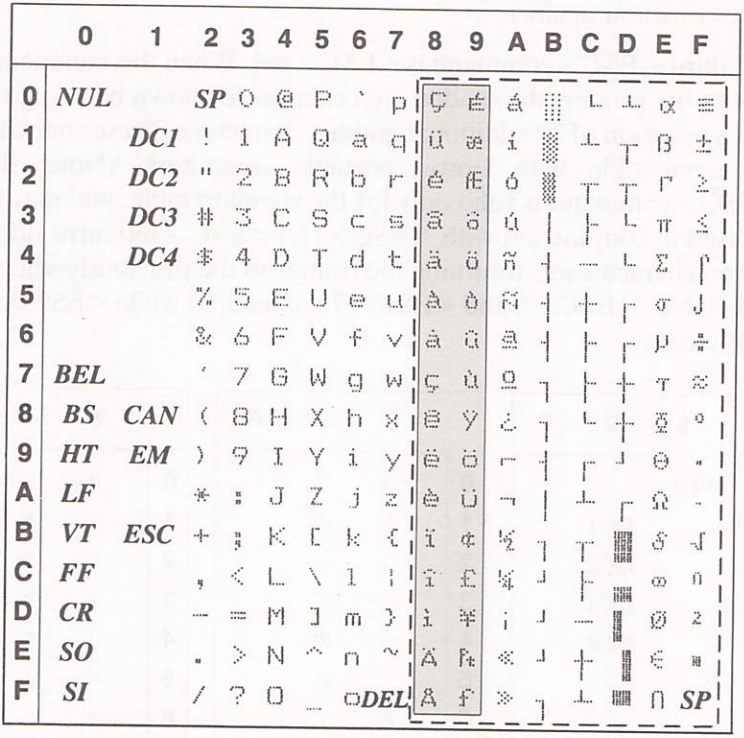
	8	9
0	┼	○
1	┴	╬
2	┬	╬
3	┤	╬
4	├	╬
5	─	╩
6	│	≈
7	┌	♣
8	┐	╬
9	└	╚
A	┘	╔
B	▒	†
C	▓	╩
D	▓	✕
E	▌	÷
F	╬	±

After <ESC> m4

Figure A-2. Three versions of standard character set

Character/graphic set

If you wish, the LX-86 can be made compatible with the IBM character/graphic set. This can be done as a default setting by supplying power to the printer with DIP switch 1-2 in the ON position, or by sending <ESC> t1 to the printer. This converts the codes in the standard set normally used for italic characters into the graphic set shown below which is used by IBM printers. <ESC> t0 returns the codes to the standard set.



* The area surrounded by the broken line is the area affected by <ESC> t1. The shaded area can be changed by <ESC> 6 and <ESC> 7.

Figure A-3. Character/graphic set

As with the standard character set, the two shaded columns of the character/graphic set can be changed. In this case, <ESC>7 changes the codes from international characters into control codes as shown below. <ESC> 6 converts them back.

	8	9
0	Ç	É
1	ü	æ
2	é	Æ
3	â	ô
4	ä	ö
5	à	ò
6	å	û
7	ç	ù
8	ê	ÿ
9	ë	Ö
A	è	Ü
B	ï	¢
C	î	£
D	ì	¥
E	Ä	₧
F	Å	ƒ

Before change

	8	9
0		
1		*DC1*
2		*DC2*
3		*DC3*
4		*DC4*
5		
6		
7	*BEL*	
8	*BS*	*CAN*
9	*HT*	*EM*
A	*LF*	
B	*VT*	*ESC*
C	*FF*	
D	*CR*	
E	*SO*	
F	*SI*	

After <ESC>7

Figure A-4. Two versions of character/graphic set

How to Use the Charts

To determine the decimal number that prints a particular character, first locate the character you want in Figure A-1 or A-3. Then look at the top of its column and the beginning of its row. The number at the top of the column is the first digit of the character's hex code, and the number at the beginning of the row is the second digit of the hex code.

For example, find the capital Z in Figure A-1. At the top of its column is 5 and at the beginning of its row is A. Therefore the hex code for capital Z is 5A.

Now that you have the hex code, you can easily convert it to the decimal number using the chart below. Just read down the column for the first digit of the hex number and across the row for the second digit. Where the two intersect you will find the equivalent decimal value. Thus, to find the decimal equivalent of hex 5A, look where column 5 intersects row A. There you will find decimal 90.

Table A-1. Hex-to-Decimal conversion chart

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240
1	1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241
2	2	18	34	50	66	82	98	114	130	146	162	178	194	210	226	242
3	3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243
4	4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244
5	5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245
6	6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246
7	7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247
8	8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248
9	9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249
A	10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250
B	11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251
C	12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252
D	13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253
E	14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254
F	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255

Appendix B
Software Commands in Numerical Order

The following list shows the control codes and <ESC> sequences which the LX-86 uses. For further details on their use, consult the index to find out where they may be discussed in the text, or Appendix C for details of the correct syntax for their use.

	7	BEL	Sounds buzzer
	8	BS	Backspace
	9	HT	Executes horizontal tab
	10	LF	Line feed
	11	VT	Executes vertical tab
	12	FF	Form feed
	13	CR	Carriage return
	14	SO	Double-width print (one line)
	15	SI	Condensed pitch
	17	DC1	Select printer
	18	DC2	Cancels condensed mode
	19	DC3	Deselect printer
	20	DC4	Cancels double-width print
	24	CAN	Cancels data in the print buffer
ESC	14	ESC SO	Same as SO
ESC	15	ESC SI	Same as SI
ESC	25	ESC EM	Cut sheet feeder mode
ESC	27	ESC ^	Selects 9-pin graphics mode
ESC	33	ESC !	Selects print mode
ESC	37	ESC %	Selects user-defined set
ESC	38	ESC &	Defines user-defined character
ESC	42	ESC *	Select graphics mode
ESC	45	ESC -	Underline
ESC	47	ESC /	Selects vertical tab format
ESC	48	ESC 0	1/8 inch line spacing
ESC	49	ESC 1	7/72 inch line spacing
ESC	50	ESC 2	1/6 inch line spacing
ESC	51	ESC 3	n/216 inch line spacing
ESC	52	ESC 4	Italic print
ESC	53	ESC 5	Cancels italic print
ESC	54	ESC 6	Cancels upper control codes
ESC	55	ESC 7	Enables upper control codes
ESC	56	ESC 8	Paper end sensor—OFF
ESC	57	ESC 9	Paper end sensor—ON

ESC	58	ESC :	Copies ROM user-defined character set into RAM
ESC	60	ESC <	Unidirectional print (one line)
ESC	63	ESC ?	Reassigns graphic mode
ESC	64	ESC @	Initializes printer
ESC	65	ESC A	n/72 inch line spacing
ESC	66	ESC B	Sets vertical tabs
ESC	67	ESC C	Page length
ESC	68	ESC D	Sets horizontal tab
ESC	69	ESC E	Emphasized print
ESC	70	ESC F	Cancels emphasized print
ESC	71	ESC G	Double-strike print
ESC	72	ESC H	Cancels double-strike print
ESC	74	ESC J	n/216 inch line feed
ESC	75	ESC K	Sets single density graphics mode
ESC	76	ESC L	Sets double density graphics mode
ESC	77	ESC M	Elite pitch
ESC	78	ESC N	Sets skip over perforation
ESC	79	ESC O	Cancels skip over perforation
ESC	80	ESC P	Pica pitch
ESC	81	ESC Q	Sets right margin
ESC	82	ESC R	Selects character set
ESC	83	ESC S	Super/subscript
ESC	84	ESC T	Cancels super/subscript
ESC	85	ESC U	Unidirectional printing
ESC	87	ESC W	Double-width print
ESC	89	ESC Y	Sets high speed double density graphics mode
ESC	90	ESC Z	Sets quadruple density graphics mode
ESC	94	ESC ^	Selects 9-pin graphics mode
ESC	97	ESC a	Sets format justification
ESC	98	ESC b	Presets vertical format
ESC	101	ESC e	Horizontal/vertical tab
ESC	102	ESC f	Paper feed/tab execute
ESC	108	ESC l	Sets left margin
ESC	109	ESC m	Special graphic character
ESC	115	ESC s	Half-speed printing
ESC	116	ESC t	Selects character set
ESC	120	ESC x	Selects draft/NLQ mode
	127	DEL	Cancels last character

Appendix C
Command Summary

Configuration

ESC @ — Initialize Printer

Format:

ASCII code:	<ESC>	@
Decimal:	27	64
Hexadecimal:	1B	40

Explanation:

Resets the printer to the power-on state, including top of form. Clears the buffer of all data entered before the command but not after.

ESC s — Select Half Speed Mode

Format:

ASCII code:	<ESC>	s	(n)
Decimal:	27	115	(n)
Hexadecimal:	1B	73	(n)

Explanation:

Selects half speed printing if n = 1 or returns to full speed if n = 0.

ESC < — Set Unidirectional Mode (one line)

Format:

ASCII code:	<ESC>	<
Decimal:	27	60
Hexadecimal:	1B	3C

Explanation:

Sets unidirectional printing for more accurate positioning during text printing for one line only. It is cancelled by a carriage return. (Graphics printing is always unidirectional.)

ESC U (n) — Set Unidirectional Mode

Format:

ASCII code:	<ESC>	U	(n)
Decimal:	27	85	(n)
Hexadecimal:	1B	55	(n)

Explanation:

Sets unidirectional printing for more accurate positioning during text printing. If n = 1 unidirectional mode is enabled while n = 0 disables the feature. (Graphic printing is always unidirectional.)

DC3 — Deselect Printer

Format:

ASCII code:	<DC3>
Decimal:	19
Hexadecimal:	13
Control:	Ctrl S

Explanation:

Places the printer in off-line mode until the select printer code <DC1> is received.

DC1 — Select Printer

Format:

ASCII code:	<DC1>
Decimal:	17
Hexadecimal:	11
Control:	Ctrl Q

Explanation:

Returns the printer to the on-line mode if it has been switched off by the printer deselect code <DC3>.

ESC 8 — Disable Paper-Out Sensor

Format:

ASCII code:	<ESC>	8
Decimal:	27	56
Hexadecimal:	1B	38

Explanation:

Turns off the paper sensor so that you can print right to the base of a single sheet of paper. This command temporarily duplicates the function of DIP switch SW1-5.

ESC 9 — Enable Paper-Out Sensor

Format:

ASCII code:	<ESC>	9
Decimal:	27	57
Hexadecimal:	1B	39

Explanation:

Turns on paper-out sensor so that the printer buzzer sounds when the printer runs out of paper.

ESC <EM> (n) — Cut Sheet Feeder Control

Format:

ASCII code:	<ESC>	<EM>	(n)
Decimal:	27	25	(n)
Hexadecimal:	1B	19	(n)
Control:	Ctrl [	Ctrl Y	(n)

Explanation:

This command is used with the optional cut-sheet feeder. When n = 0 the feeder is turned off, when n = 4 it is turned on. Using DIP Switch 1-3 produces the same effect.

Miscellaneous Character Codes

CR — Carriage Return

Format:

ASCII code:	**<CR>**
Decimal:	**13**
Hexadecimal:	**0D**
Control:	**Ctrl M**

Explanation:

Prints the data in the buffer and returns the print head to the left margin. A line feed may also be added if either SW1-3 is ON or the AUTO FEED XT line on the parallel printer interface is held "LOW".

BEL — Bell Character

Format:

ASCII code:	**<BEL>**
Decimal:	**7**
Hexadecimal:	**7**
Control:	**Ctrl G**

Explanation:

Sounds the LX-86 buzzer for a quarter of a second.

BS — Backspace

Format:

ASCII code:	**<BS>**
Decimal:	**8**
Hexadecimal:	**08**
Control:	**Ctrl H**

Explanation:

The print head is moved one space to the left. This allows the characters to be printed on top of one another. The two characters are printed together without an actual backspace movement taking place. The character is ignored when the carriage is at the left of the printer, or if the printer is in graphic mode.

DEL — Delete Character

Format:

ASCII code:	**<DEL>**
Decimal:	**127**
Hexadecimal:	**7F**

Explanation:

Deletes the previous character in the buffer unless that character has already been printed. It cannot be guaranteed to function if italics are being printed.

CAN — Cancel Line

Format:

ASCII code:	**<CAN>**
Decimal:	**24**
Hexadecimal:	**18**
Control:	**Ctrl X**

Explanation:

Deletes all data on the same line ahead of this character.

Paper Line Feed Commands

LF — Line Feed

Format:

ASCII code:	<LF>
Decimal:	10
Hexadecimal:	0A
Control:	Ctrl J

Explanation:

When this command is given, the data in the print buffer is printed and the paper advances one line according to the current line spacing.

ESC 0 — Set 1/8 Inch Line Spacing

Format:

ASCII code:	<ESC>	0
Decimal:	27	48
Hexadecimal:	1B	30

Explanation:

Sets the line spacing to 1/8 of an inch for subsequent line feed commands. The "0" is the digit zero and not the character with ASCII code 0.

ESC 1 — Set 7/72 Inch Line Spacing

Format:

ASCII code:	<ESC>	1
Decimal:	27	49
Hexadecimal:	1B	31

Explanation:

Sets the line spacing to 7/72 of an inch for subsequent line feed commands. The "1" is the digit one and not lower case L.

ESC 2 — Set 1/6 Inch Line Spacing

Format:

ASCII code:	<ESC>	2
Decimal:	27	50
Hexadecimal:	1B	32

Explanation:

Sets the line spacing to 1/6 of an inch for subsequent line feed commands. The "2" is the digit two and not the character with ASCII code 2. This is the default at power on.

ESC 3 (n) — Set n/216 Inch Line Spacing

Format:

ASCII code:	<ESC>	3	(n)
Decimal:	27	51	(n)
Hexadecimal:	13	33	(n)

Explanation:

Sets the line spacing to n/216 of an inch for subsequent <LF> commands. The "3" is the digit three and not the character with ASCII code 3. The vertical spacing of the dots on the LX-86 is 1/216 of an inch. The value of n should be in the range 0 to 255.

ESC J (n) — n/216 Inch Line Feed for One Line

Format:

ASCII code:	<ESC>	J	(n)
Decimal:	27	74	(n)
Hexadecimal:	1B	4A	(n)

Explanation:

Advances the paper by one line at a spacing of n/216 of an inch (n/3 dots). The value of n should be in the range 0 to 255. This command does not send a carriage return with the line feed.

ESC A (n) — Set n/72 Inch Line Spacing

Format:

ASCII code:	<ESC>	A	(n)
Decimal:	27	65	(n)
Hexadecimal:	13	41	(n)

Explanation:

Sets the line spacing to n/72 of an inch (n dots) for subsequent line feed commands. The vertical spacing of the dots on the LX-86 is 1/216 of an inch. The value of n should be in the range 0 to 85.

Paper Form Feed Commands

FF — Form Feed

Format:

ASCII code:	<FF>
Decimal:	12
Hexadecimal:	0C
Control:	Ctrl L

Explanation:

When this command is given, the data in the print buffer is printed and the paper advances to the top of the next page according to the current page length.

ESC C (n) — Set Page Length in Lines

Format:

ASCII code:	<ESC>	C	(n)
Decimal:	27	67	(n)
Hexadecimal:	1B	43	(n)

Explanation:

Sets the page length to n lines. The value of n should be in the range 1 to 127.

ESC C <NUL> (n) — Set Page Length in Inches

Format:

ASCII code:	<ESC>	C	<NUL>	(n)
Decimal:	27	67	0	(n)
Hexadecimal:	1B	43	00	(n)
Control:	Ctrl [	C	Ctrl @	(n)

Explanation:

Sets the page length to n inches where n has a value of 1 to 22.

Vertical Formatting Commands

ESC N (n) — Set Skip Over Perforation

Format:

ASCII code:	<ESC>	N	(n)
Decimal:	27	78	(n)
Hexadecimal:	1B	4E	(n)

Explanation:

Sets a margin at the bottom of the page. Apart from the ability to set the margin, this command is useful to prevent printing over the perforations on fanfold paper.

ESC O — Cancel Skip Over Perforation

Format:

ASCII code:	<ESC>	O
Decimal:	27	79
Hexadecimal:	1B	4F

Explanation:

The bottom margin is set to zero lines. This means printing will continue to print over the perforation when printing a listing, for example, when no counting of the lines is being carried out by the computer.

ESC B (n1) (n2) (0) — Set Vertical Tabs

Format:

ASCII code:	<ESC>	B	(n1)	(n2)	...	<NUL>
Decimal:	27	66	(n1)	(n2)	...	0
Hexadecimal:	1B	42	(n1)	(n2)	...	00

Explanation:

This command allows setting of up to 16 vertical tabs. The tabs can be set in 8 channels using the <ESC> b command. This command sets the tabs in channel 0. These are entered as n1, n2, n3 etc (in the range 1 to 254) with the <NUL> character as the terminator. The tab settings n1, n2, n3 etc must be entered in ascending order. The tab settings can be cleared by executing the command giving a value of zero to n1. Altering the line spacing after giving this command does not affect the absolute position of the tab setting.

ESC b (c) (n1) (n2) (0) Set Vertical Tabs in Channels

Format:

ASCII code:	<ESC>	b	(c)	(n1)	(n2)	...	<NUL>
Decimal:	27	66	(c)	(n1)	(n2)	...	0
Hexadecimal:	1B	42	(c)	(n1)	(n2)	...	00

Explanation:

This command allows setting of up to 16 vertical tabs. The tabs can be set in 8 channels (the range of c is 0 to 7). The channel set by <ESC> b is channel 0. These are entered as n1, n2, n3 etc (in the range 1 to 254) with the <NUL> character as the terminator. The tab settings n1, n2, n3 etc must be entered in ascending order. The tab settings can be cleared by executing the command giving a value of zero to n1. Altering the line spacing after giving this command does not affect the absolute position of the tab setting.

ESC / (c) Select Vertical Tab Channel

Format:

ASCII code:	<ESC>	/	(c)
Decimal:	27	47	(c)
Hexadecimal:	13	2F	(c)

Explanation:

This command is used to set the vertical tab channel, where c has the value 0 to 7.

VT Tab Vertically

Format:

ASCII code:	<VT>
Decimal:	11
Hexadecimal:	0B
Control:	Ctrl K

Explanation:

Advances the paper to the next tab setting in the channel selected by <ESC> / c. If no channel has been set, channnel 0 is used. If no vertical tabs have been set, the paper advances one line.

ESC e 1 (s) — Set Vertical Tab Increments

Format:

ASCII code:	<ESC>	e	1	(s)
Decimal:	27	101	1	(s)
Hexadecimal:	1B	65	1	(s)

Explanation:

This command sets vertical tab increments. The vertical tabs are set to s line feeds where the line spacing is as defined in the line feed command.

ESC f 1 (s) — Vertical Skip

Format:

ASCII code:	<ESC>	f	1	(s)
Decimal:	27	102	1	(s)
Hexadecimal:	1B	66	1	(s)

Explanation:

Performs s line feeds without carriage returns.

Horizontal Formatting Commands

HT — Tab Horizontally

Format:

ASCII code:	<HT>
Decimal:	9
Hexadecimal:	9
Control:	Ctrl I

Explanation:

When this command is given the print head is advanced to the next horizontal tab setting.

ESC Q (n) — Set Right Margin

Format:

ASCII code:	<ESC>	Q	(n)
Decimal:	27	81	(n)
Hexadecimal:	1B	51	(n)

Explanation:

This command must be given at the beginning of the line. The data in the print buffer is lost and the right margin is set to n columns of the current character width. When the right margin is reached, a carriage return and line feed is added to the characters being printed.

ESC l (n) — Set Left Margin

Format:

ASCII code:	<ESC>	l	(n)
Decimal:	27	108	(n)
Hexadecimal:	1B	6C	(n)

Explanation:

The character "l" is a lower case "L" as in "hello". This command should be placed at the beginning of a line. The data in the print buffer is lost and the left margin is set to n columns of the current character width. The value of n should be in the range 0 to 160, but will be ignored if the setting would give a margin of more than 8 inches.

ESC D (n1) (n2) (0) — Set Horizontal Tabs

Format:

ASCII code:	<ESC>	D	(n1)	(n2)	...	<NUL>
Decimal:	27	68	(n1)	(n2)	...	0
Hexadecimal:	1B	44	(n1)	(n2)	...	00

Explanation:

This command allows setting of up to 32 horizontal tabs. These are entered as n1, n2, n3 etc (in the range 1 to 137) with the <NUL> character as the terminator. The tab settings n1, n2, n3 etc must be entered in ascending order. The tab settings can be cleared by executing the command with n1 set to zero. The settings on power up or after an <ESC> @ command are every eight characters.

ESC e 0 (s) — Set Horizontal Tab Increments

Format:

ASCII code:	<ESC>	e	0	(s)
Decimal:	27	101	0	(s)
Hexadecimal:	1B	65	0	(s)

Explanation:

This command sets the horizontal increments. The horizontal tabs are set at intervals of s spaces. Maximum values are 21 in pica, 25 in elite and 36 in condensed text modes.

ESC f 0 (s) — Horizontal Skip

Format:

ASCII code:	<ESC>	f	0	(s)
Decimal:	27	102	0	(s)
Hexadecimal:	1B	66	0	(s)

Explanation:

Prints spaces without carriage returns. S spaces will be inserted up to a maximum of 127.

Format:

ASCII code:	<ESC>	a	(n)
Decimal:	27	97	(n)
Hexadecimal:	1B	61	(n)

Explanation:

See Chapter 7 for the use and control of justification.

General Print Style Selection

ESC ! (n) — Select Master Style

Format:

ASCII code:	<ESC>	!	(n)
Decimal:	27	33	(n)
Hexadecimal:	1B	21	(n)

Explanation:

This command enables a number of commands to be added together. The value of n determines the combination to be used. Full details of the values and examples are given in Chapter 6.

ESC x (n) — Select Print Mode

Format:

ASCII code:	<ESC>	x	(n)
Decimal:	27	120	(n)
Hexadecimal:	1B	78	(n)

Explanation:

Selects draft mode if n = 0 or Near Letter Quality (NLQ) mode if n = 1.

ESC M — Select Elite Pitch

Format:

ASCII code:	<ESC>	M
Decimal:	27	77
Hexadecimal:	1B	4D

Explanation:

Selects elite pitch (12 characters per inch).

Format:

ASCII code:	<ESC>	P
Decimal:	27	80
Hexadecimal:	1B	50

Explanation:

Selects pica pitch (10 characters per inch). This is the default character width and so this command is normally used to cancel the elite pitch.

Print Size Commands

SI — Set Condensed Characters

Format:

ASCII code:	<SI>
Decimal:	15
Hexadecimal:	0F
Control:	Ctrl O

Explanation:

This command is only effective in draft mode. It produces characters which are half the width of the normal draft characters.

ESC SI — Set Condensed Characters

Format:

ASCII code:	<ESC>	<SI>
Decimal:	27	15
Hexadecimal:	1B	0F

Explanation:

Duplicates the <SI> command.

DC2 — Cancel Condensed Print

Format:

ASCII code:	<DC2>
Decimal:	18
Hexadecimal:	12
Control:	Ctrl R

Explanation:

This command cancels the condensed printing set by <SI> and <ESC> <SI>.

SO — Set Double-Width Characters (one line)

Format:

ASCII code:	**<SO>**
Decimal:	**14**
Hexadecimal:	**0E**
Control:	**Ctrl N**

Explanation:

This command sets the characters to twice the width of the normal characters. It is cancelled by a carriage return unless deliberately cancelled sooner by <DC4>.

ESC SO — Set Double-Width Characters (one line)

Format:

ASCII code:	**<ESC>**	**<SO>**
Decimal:	**27**	**14**
Hexadecimal:	**1B**	**0E**

Explanation:

Duplicates the <SO> command.

DC4 — Cancel Double-Width Characters (one line)

Format:

ASCII code:	**<DC4>**
Decimal:	**20**
Hexadecimal:	**14**
Control:	**Ctrl T**

Explanation:

Cancels the one-line double-width printing set by <SO> or <ESC> <SO>, but not the double-width printing set by <ESC> W or <ESC> !.

ESC W (n) — Select Double-Width Characters

Format:

ASCII code:	<ESC>	W	(n)
Decimal:	27	87	(n)
Hexadecimal:	1B	57	(n)

Explanation:

This command turns double-width characters on (when n = 1) until switched off (when n = 0).

ESC E — Set Emphasized Print

Format:

ASCII code:	<ESC>	E
Decimal:	27	69
Hexadecimal:	1B	45

Explanation:

This command produces a more intense character at a reduced speed by printing the character a second time at a position slightly shifted along the line. It may be used in conjunction with double-strike mode.

ESC F — Cancel Emphasized Print

Format:

ASCII code:	<ESC>	F
Decimal:	27	70
Hexadecimal:	1B	46

Explanation:

Turns off the emphasized mode set by <ESC> E.

ESC G — Set Double-Strike Mode

Format:

ASCII code:	<ESC>	G
Decimal:	27	71
Hexadecimal:	1B	47

Explanation:

Causes the character to be printed twice thus making the character bolder. It may be used in conjunction with emphasized print. It causes the printer speed to reduce because it is printing twice.

ESC H — Cancel Double-Strike Mode

Format:

ASCII code:	<ESC>	H
Decimal:	27	72
Hexadecimal:	1B	47

Explanation:

Turns off double-strike mode set by <ESC> G.

ESC S (n) — Set Superscript/Subscript

Format:

ASCII code:	<ESC>	S	(n)
Decimal:	27	83	(n)
Hexadecimal:	1B	53	(n)

Explanation:

This command either selects superscript (when n = 0) or subscript (when n = 1).

ESC T — Cancel Superscript/Subscript

Format:

ASCII code:	<ESC>	T
Decimal:	27	84
Hexadecimal:	1B	54

Explanation:

Turns off either superscript or subscript.

ESC – (n) — Select Underlining

Format:

ASCII code:	<ESC>	–	(n)
Decimal:	27	45	(n)
Hexadecimal:	1B	2D	(n)

Explanation:

When the value of n = 1, underlining is turned on, when n = 0, underlining is turned off.

Alternative Character Sets

ESC R (n) — Select International Character Set

Format:

ASCII code:	<ESC>	R	(n)
Decimal:	27	82	(n)
Hexadecimal:	1B	52	(n)

Explanation:

Some character codes produce different characters for different countries. The characters are outlined in Chapter 6. The value of n determines which character set is printed. The countries corresponding to the values of n are:

n	Country	n	Country
0	USA	6	Italy
1	France	7	Spain
2	Germany	8	Japan
3	United Kingdom	9	Norway
4	Denmark I	10	Denmark II
5	Sweden		

ESC 4 — Set Italic Characters

Format:

ASCII code:	<ESC>	4
Decimal:	27	52
Hexadecimal:	1B	34

Explanation:

This command causes characters to be printed using the italic character set.

ESC 5 — Cancel Italic Characters

Format:

ASCII code:	<ESC>	5
Decimal:	27	53
Hexadecimal:	1B	35

Explanation:

Cancels the italic printing set by <ESC> 4.

ESC & Define User-Defined Characters

Format:

ASCII code:	<ESC>	&	<NUL>	(m)	(n)	(s)(data 1) ...
Decimal:	27	38	0	(m)	(n)	(s)(data 1) ...
Hexadecimal:	1B	26	00	(m)	(n)	(s)(data 1) ...

Explanation:

This command allows characters to be re-defined in the currently selected mode. The mode to be used must be selected before downloading the character(s). m should be 0 and n and s should be in the range of 58 to 63. Chapter 8 gives an outline of the method used and the significance of the codes.

ESC : Copy ROM Into User-Defined Characters

Format:

ASCII code:	<ESC>	:	<NUL>	<NUL>	<NUL>
Decimal:	27	58	0	0	0
Hexadecimal:	1B	3A	00	00	00

Explanation:

This code allows the characters in the LX-86 ROM to be copied into the user-defined character set so that specific characters can be redefined. Select the mode to be used (draft or Near Letter Quality as required) to ensure the correct set is copied.

ESC % Select User-Defined Set

Format:

ASCII code:	<ESC>	%	(n)
Decimal:	27	37	(n)
Hexadecimal:	1B	25	(n)

Explanation:

This code selects the user-defined set if n = 1 and the normal set if n = 0. ESC ! and ESC & are required to define the character set.

ESC m (n) — Select Special Graphic Character

Format:

ASCII code:	<ESC>	m	(n)
Decimal:	27	109	(n)
Hexadecimal:	1B	6D	(n)

Explanation:

This code allows ASCII codes 128 to 159 to print special graphics characters. This command will be ignored if the Character/ Graphic Set is selected. See Chapter 6 for details.

ESC t (n) — Select Character Set

Format:

ASCII code:	<ESC>	t	(n)
Decimal:	27	116	(n)
Hexadecimal:	1B	74	(n)

Explanation:

When n = 0, the standard character set is selected – the upper half of the character table contains italic characters. When n = 1, the character graphic set is selected which contains graphic characters like those used by IBM printers. Consult Appendix A for the difference between the two sets.

ESC 6 — Cancel Upper Control Codes

Format:

ASCII code:	<ESC>	6
Decimal:	27	54
Hexadecimal:	1B	36

Explanation:

After the <ESC> 6 command, the ASCII codes between 128 (80 hex) and 159 (9F hex) are interpreted as printable international characters.

ESC 7 Enable Upper Control Codes

Format:

ASCII code:	<ESC>	7
Decimal:	27	55
Hexadecimal:	1B	37

Explanation:

After the <ESC> 7 command, the codes between 128 (80 hex) and 159 (9F hex) are interpreted as control codes duplicating those between 0 and 31 (1F hex).

Graphics (Bit Image) Commands

ESC K — Set Single Density Graphics Mode

Format:

ASCII code:

<ESC> K (n1) (n2) (data1) (data2) ... (data(d))

Decimal:

27 75 (n1) (n2) (data1) (data2) ... (data(d))

Hexadecimal:

1B 4B (n1) (n2) (data1) (data2) ... (data(d))

Explanation:

Turns on Single Density Graphics Mode. Printing 480 dots per 8-inch line. Where d is the total number of dots required n1 and n2 are calculated thus:

n1 = d MOD 256 and n2 = INT(d / 256).

and are followed by d data bytes.

ESC L — Set Double Density Graphics Mode

Format:

ASCII code:

<ESC> L (n1) (n2) (data1) (data2) ... (data(d))

Decimal:

27 76 (n1) (n2) (data1) (data2) ... (data(d))

Hexadecimal:

1B 4C (n1) (n2) (data1) (data2) ... (data(d))

Explanation:

Turns on Low-Speed Double Density Graphics Mode. Printing 960 dots per 8-inch line. Where d is the total number of dots required n1 and n2 are calculated thus:

n1 = d MOD 256 and n2 = INT(d / 256).

and are followed by d data bytes.

ESC Y Set High Speed Double Density Graphics Mode

Format:

ASCII code:

<ESC> Y (n1) (n2) (data1) (data2) ... (data(d))

Decimal:

27 89 (n1) (n2) (data1) (data2) ... (data(d))

Hexadecimal:

1B 59 (n1) (n2) (data1) (data2) ... (data(d))

Explanation:

Turns on High-Speed Double Density Graphics Mode. Printing 960 dots per 8-inch line. Similar to ESC L but cannot print two adjacent dots on the same row. Where d is the total number of dots required n1 and n2 are calculated thus:

n1 = d MOD 256 and n2 = INT(d / 256).

and are followed by d data bytes.

ESC Z Set Quadruple Density Graphics Mode

Format:

ASCII code:

<ESC> Z (n1) (n2) (data1) (data2) ... (data(d))

Decimal:

27 90 (n1) (n2) (data1) (data2) ... (data(d))

Hexadecimal:

1B 5A (n1) (n2) (data1) (data2) ... (data(d))

Explanation:

Turns on Quadruple Density Graphics Mode. Printing 1920 dots per 8-inch line. Where d is the total number of dots required n1 and n2 are calculated thus:

n1 = d MOD 256 and n2 = INT(d / 256).

and are followed by d data bytes.

ESC * — Select Graphics Mode

Format:

ASCII code:

<ESC> * (m) (n1)(n2) (data1) (data2) ... (data(d))

Decimal:

27 42 (m) (n1)(n2) (data1) (data2) ... (data(d))

Hexadecimal:

1B 2A (m) (n1)(n2) (data1) (data2) ... (data(d))

Explanation:

Select Graphics Mode where m is mode 0 to 6. Where d is the total number of dots required n1 and n2 are calculated thus:

n1 = d MOD 256 and n2 = INT(d / 256).

and are followed by d data bytes.

ESC ? — Reassign Graphics Mode

Format:

ASCII code:	**<ESC>**	**?**	**(s)**	**(n)**
Decimal:	**27**	**63**	**(s)**	**(n)**
Hexadecimal:	**1B**	**3F**	**(s)**	**(n)**

Explanation:

Change one graphics mode to another. The mode s is the ASCII code for the character K, L, Y, or Z which is to reassigned to a mode 0–6 as in the <ESC> * command. Details of the modes are given in Chapter 9.

Format:

ASCII code:

<ESC> Λ (m) (n1)(n2) (data1) (data2) ... (data(d))

Decimal:

27 94 (m) (n1)(n2) (data1) (data2) ... (data(d))

Hexadecimal:

1B 5E (m) (n1)(n2) (data1) (data2) ... (data(d))

Explanation:

Turns on 9-Pin Graphics Mode. Where m defines density of print (0 for single and 1 for double) and d is the total number of dots required n1 and n2 are calculated thus:

n1 = d MOD 256 and n2 = INT(d / 256).

and are followed by two times d data bytes. The printer expects two data items for each column of print.

Appendix D
The DIP Switches

Whereas it is possible to change various functions temporarily using control codes or <ESC> sequences, it is frequently more convenient to have the printer defaults set in a particular configuration when the printer is switched on. There are several tiny switches called DIP (for Dual In-Line Package) switches on the back of the LX-86 printer. They control a number of important printer functions such as page length, the international character set and NLQ or draft mode printing. For most uses they can be left as they were set at the factory, but you may need to change some settings to suit your computer system or the type of work you are doing with the LX-86.

The design of the LX-86 gives you easy access to the switches. You can see them in a pair of recesses on the back of the printer as shown in Figure D-1.

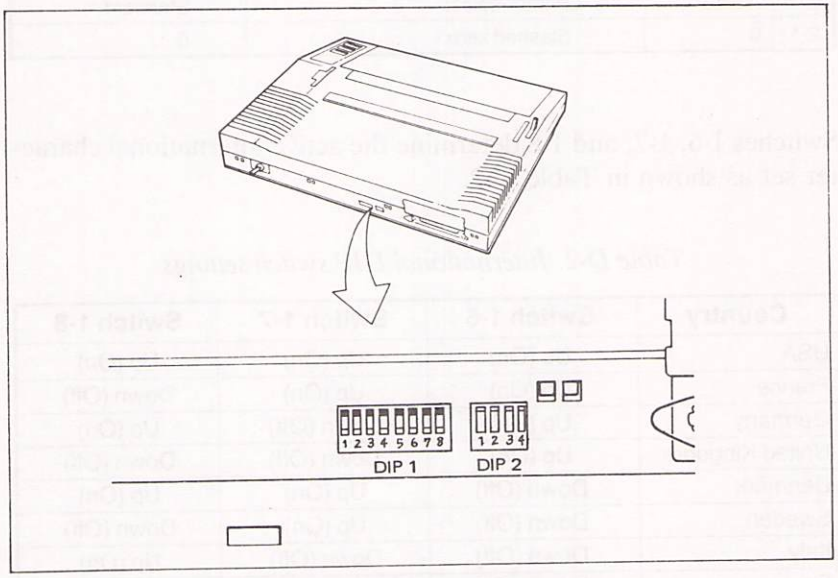


Figure D-1. DIP switch location

Before changing any of the switches, turn the power OFF (with the switch on the right side of the printer). Any changes made while the power is on will be ignored until you turn the printer off and back on or send the reset sequence <ESC> @.

Table D-1 shows the functions of all the switches. An explanation of their function follows on the next page.

Table D-1. DIP switch functions

Switch 1

No.	UP (ON)	Functions	DOWN (OFF)
1-8	See Below	International character set	
1-7	See Below	International character set	
1-6	See Below	International character set	
1-5	Inactive	Paper-out sensor	Active
1-4	12-inch	Form length	11-inch
1-3	Active	Cut-sheet feeder	Inactive
1-2	Graphics	Character table	Standard
1-1	Condensed	Print width	Pica

Switch 2

No.	UP (ON)	Functions	DOWN (OFF)
2-4	Silent	Beeper	Sounds
2-3	CR +LF	Automatic line feed	CR only
2-2	Active	Printer-select	Standard
2-1	Ø	Slashed zero	0

Switches 1-6, 1-7, and 1-8 determine the active international character set as shown in Table D-2.

Table D-2. International DIP switch settings

Country	Switch 1-6	Switch 1-7	Switch 1-8
USA	Up (On)	Up (On)	Up (On)
France	Up (On)	Up (On)	Down (Off)
Germany	Up (On)	Down (Off)	Up (On)
United Kingdom	Up (On)	Down (Off)	Down (Off)
Denmark	Down (Off)	Up (On)	Up (On)
Sweden	Down (Off)	Up (On)	Down (Off)
Italy	Down (Off)	Down (Off)	Up (On)
Spain	Down (Off)	Down (Off)	Down (Off)

The use of international sets is discussed in Chapter 6. The characters which change when the DIP switches are reset are shown in Table 6-1.

Switch 1-5 controls the paper-out sensor. When it is up (ON), the detector is inactive, causing printing to continue even when the printer is out of paper. When it is down (OFF), the printer stops when the end of the paper passes the paper-out sensor. Some computer systems ignore the setting of this switch. See Appendix F.

Switch 1-4 selects the paper length. When it is down (OFF), the length is 11″; when it is up (ON), the length is 12″.

Switch 1-3 controls the optional cut-sheet feeder. When it is up (ON), the cut-sheet feeder is enabled. When it is down (OFF), the cut-sheet feeder is disabled.

Switch 1-2 selects the graphics or standard character set. When it is up (ON), the printer prints from the character/graphic table. When it is down (OFF), it prints from the standard set.

Switch 1-1 selects condensed or pica printing. Up (ON) is condensed; down (OFF) is pica. Regardless of the setting, you can still select condensed and all of the other modes with SelecType and with <ESC> codes.

Switch 2-4 enables the beeper to sound when it is down (OFF); when it is up (ON), the beeper cannot sound.

Switch 2-3 controls line feeds. When it is up (ON), the LX-86 performs an automatic line feed with each carriage return; when it is down (OFF), the computer system must send the line feeds.

If your printing has an extra space between lines, turn the switch down (OFF). If all the lines of your printing are on top of each other, turn the switch up (ON). This switch enables the LX-86 to match computer systems which send a line feed whenever they send a carriage return and those which only send a carriage return. You may also find that even if you set the switch down (OFF) the lines are still double spaced. This is due to the interface cable between the computer and LX-86 overriding the DIP switch. The solution is to break the connection to pin 14. Consult your dealer if this is the case and you do not understand how to do this yourself.

Switch 2-2 selects the printer. When it is up (ON), the printer cannot be deactivated by software codes. When it is down (OFF), the printer is inactive until it receives the proper software code. The code for selection is ASCII code 17 (<DC1>) and for deselection is ASCII code 19 (<DC3>). Unless you understand this function or your computer or software manual tells you how to use it, leave the switch down (OFF).

Switch 2-1 controls the printing of zeros. When it is up (ON), the zeros are slashed (Ø); when it is down (OFF), they are not (0).

Appendix E
Using the Optional Tractor Unit

The optional tractor unit allows you to use continuous paper with pin feed holes along the sides. The unit is adjustable so that the continuous paper can be any width from 4 to 10 inches.

Printer Location

When you use the tractor and continuous paper, put your LX-86 where the paper can flow freely in and out of the printer. Use a printer stand or any other arrangement that fits your working area. Make sure that the paper coming out of the printer does not interfere with the paper going in and that the paper going in does not catch on the printer cable. Because of the cable, it is usually best for the paper that feeds into the printer to be stacked somewhat behind the printer instead of directly beneath it. Two possible setups are shown in Figures E-1 and E-2.

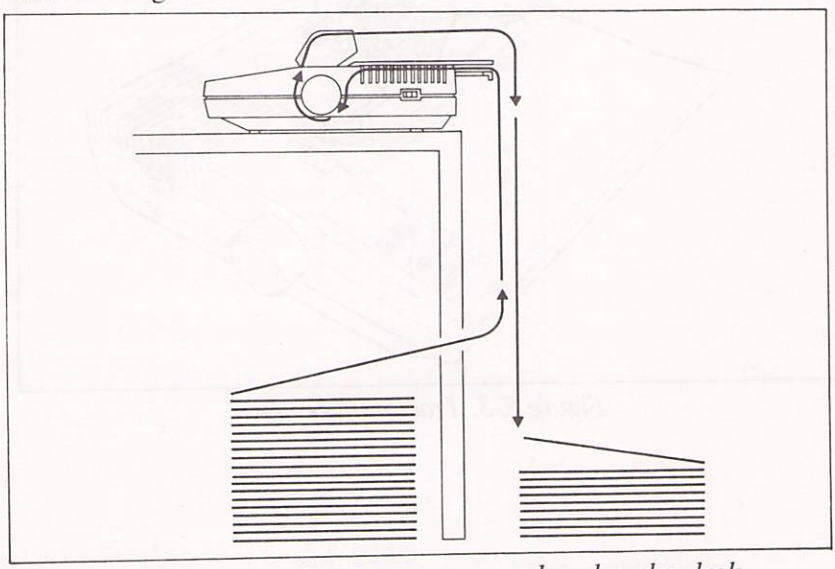


Figure E-1. Continuous paper placed under desk

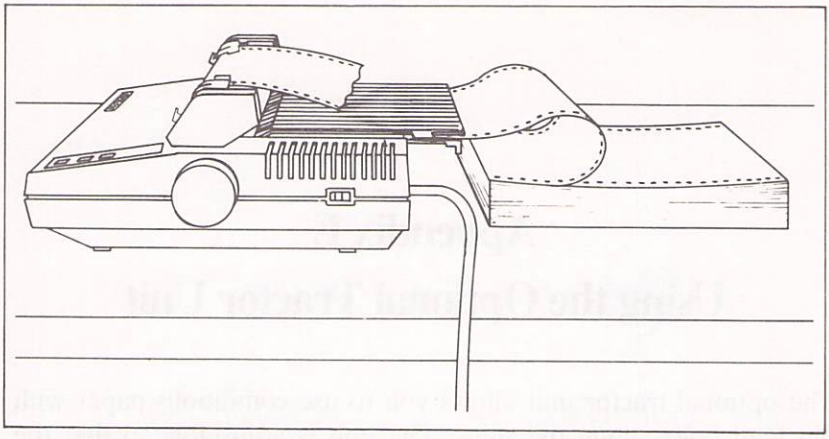


Figure E-2. Continuous paper placed behind printer

Tractor Unit Installation

To install the removable tractor unit, first pull the friction lever toward the front of the printer. Then hold the tractor with the gears to the right as shown in Figure E-3.

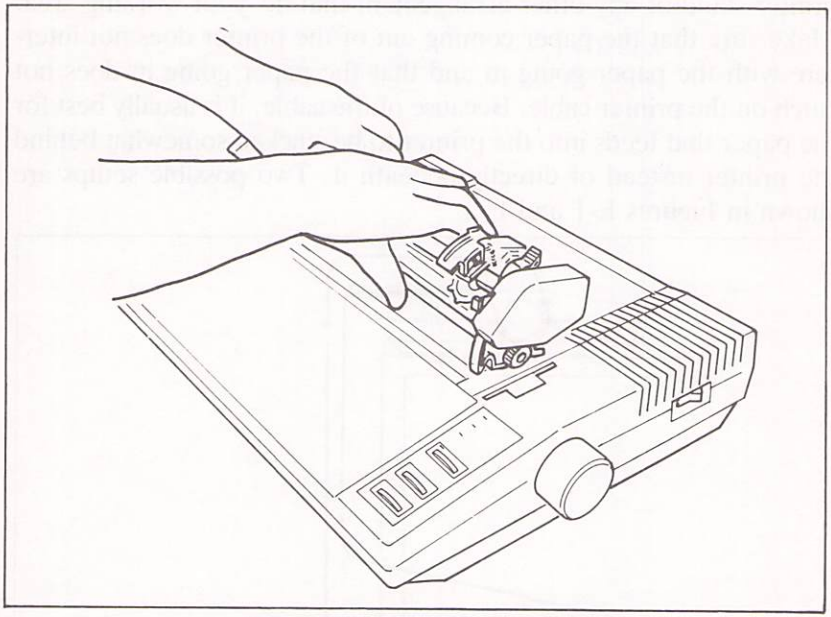


Figure E-3. Tractor placement

In each tractor slot are two pegs that fit into the notches on the tractor fittings. Tilt the tractor back so that the rear notches fit over the rear pegs. Then tilt the unit forward until it clicks into place. It is as easy as that.

Now install the paper separator and pull out the paper guide as shown in Figure E-4. Fit the notches in the bottom corners of the separator over the pins at the front of the paper slot. The separator keeps the paper that is coming out of the printer from being pulled back in. Pull out the paper guide at the back of the printer. This guide helps keep the incoming paper from catching on the printer cable.

NOTE: THIS GUIDE SHOULD NOT BE USED AS A CARRYING HANDLE.

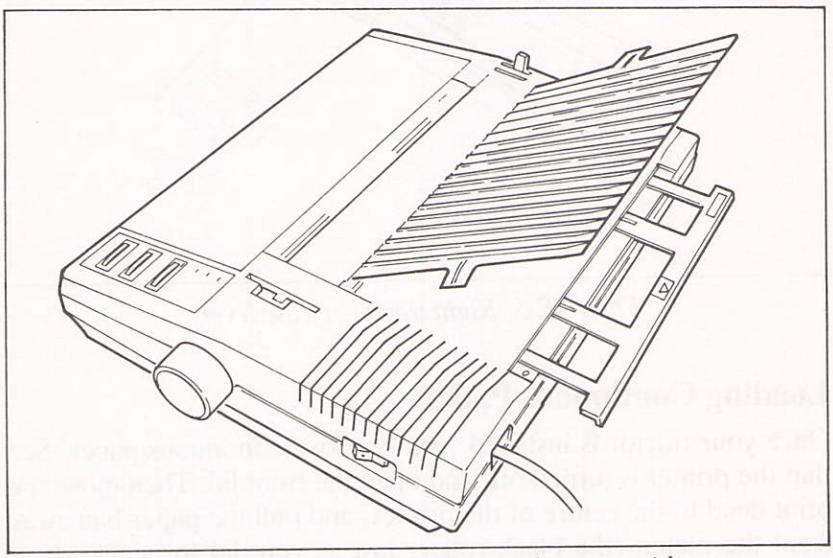


Figure E-4. Paper separator and paper guide

When you want to use single sheet paper in the LX-86, you can remove the tractor unit quite easily. Push back the two tractor release levers as shown in Figure E-5, tilt the unit backwards, and lift it up.

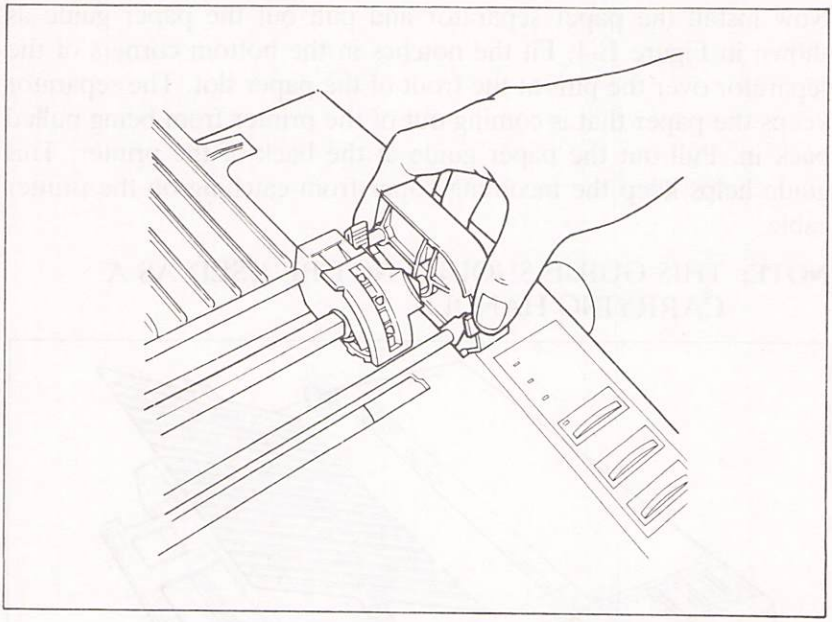


Figure E-5. Right tractor release lever

Loading Continuous Paper

Once your tractor is installed, you can load continuous paper. See that the printer is turned off, and open the front lid. Then move the print head to the centre of the printer, and pull the paper bail away from the platen (the black roller) just as you did for single sheet loading. (Look back at Figure 1-7 if you need to check on the names of any of these parts.)

Now, using Figure E-6 as your guide, pull the locking levers forward so that you can move the pin feed holders at the left and right. Put the left holder approximately 3/4 of an inch from the extreme left position and then push the locking lever back to lock that holder in place. Leave the other holder unlocked.

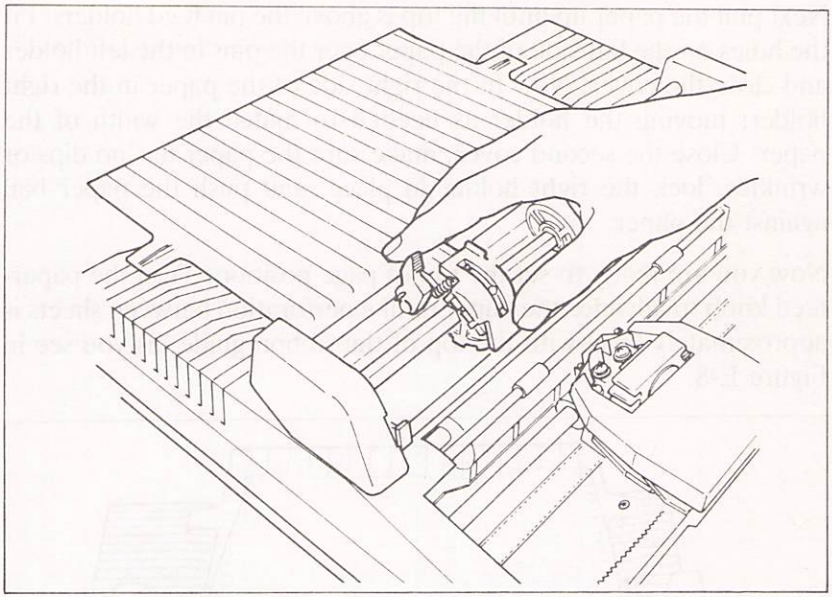


Figure E-6. Pin feed holder adjustment

Next, open the pin feed covers as shown in Figure E-7 and feed the paper under the paper separator and into the paper slot. Push the paper through until it comes up between the ribbon guide and the platen.

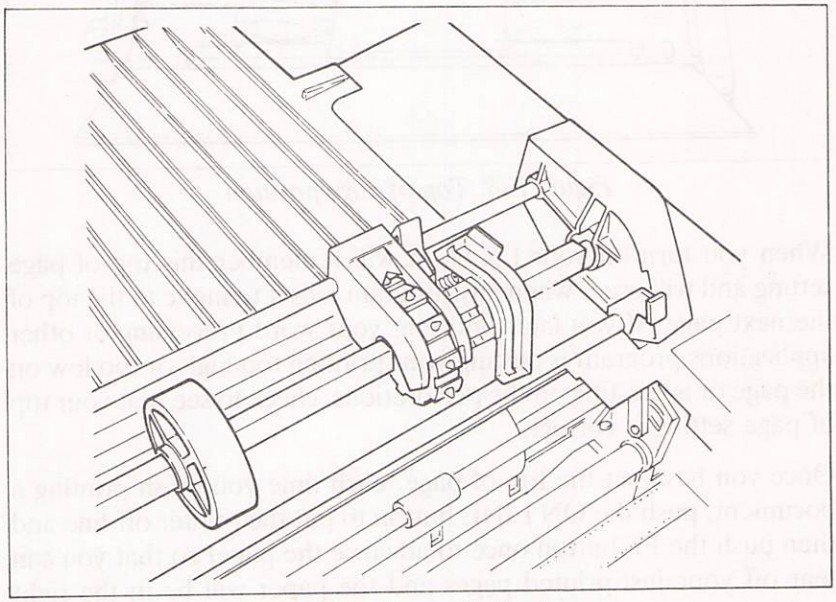


Figure E-7. Open pin feed cover

Next pull the paper up until the top is above the pin feed holders. Fit the holes on the left side of the paper over the pins in the left holder and close the cover. Now fit the right side of the paper in the right holder, moving the holder as needed to match the width of the paper. Close the second cover, make sure the paper has no dips or wrinkles, lock the right holder in place, and push the paper bail against the paper.

Now you are ready to set the top of page position. Turn the paper-feed knob to advance the paper until a perforation between sheets is approximately level with the top of the ribbon guide, as you see in Figure E-8.

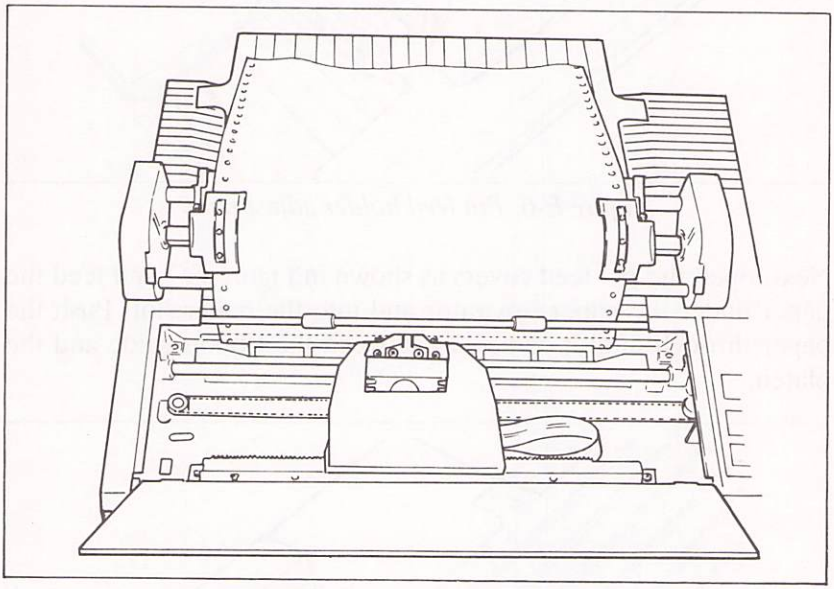


Figure E-8. Top of page position

When you turn on your LX-86, it will remember this top of page setting and will use it when any program tells it to move to the top of the next page. If you later find that your word processing or other applications program is putting your printing too high or too low on the page or is printing on the perforations, check to see that your top of page setting is correct.

Once you have set the top of page, each time you finish printing a document, push the ON LINE button to put the printer off-line and then push the FF button once to advance the paper so that you can tear off your just-printed pages and the paper will be in the right position to begin the next document.

Appendix F

Troubleshooting and Advanced Features

This appendix approaches troubleshooting from several directions. The first section matches solutions with some common general problems. Other sections cover beeper error warnings, hexadecimal data dumping, coding and 7-bit solutions, and specific solutions for several popular personal computer systems.

Problem/Solution Summary

Setting print styles

If you cannot change to condensed print, cancel emphasized. It has priority over condensed.

Tabbing

If horizontal tabs will not work and you are also setting the margin, set margins before setting the tabs, not after.

If horizontal tabs do not work, it may be that your computer will not allow the ASCII code 9 to be sent to the printer, or it may be interpretting the ASCII code 9 as a tab command, but substituting a series of spaces instead. This is likely to happen with CP/M-based machines. There may be other computers which also have problems because they cannot send the ASCII code 9. Look under the section on your computer.

If horizontal tabs are incorrect and you have changed pitch, remember that tabs are set to an absolute position according to the current print pitch. Changes in pitch do not affect the absolute position of the tabs across the page.

Graphics

If you find strange dot patterns appearing in the middle of your graphics, and at the end of the line of graphics there are text characters you did not intend, your computer may be sending a carriage return and line feed when you did not expect them. You may need to change the print width with a command like the WIDTH command in Microsoft BASIC. See your computer documentation.

Many computers have problems sending one or more of the codes between 0 and 13. Try to avoid these characters if possible. You may also be able to bypass the printer interface software which removes some of these codes. Where solutions are known they are given later in this appendix.

Seven-bit computers cannot use the eighth pin (128). If you have a 7-bit computer and any of your graphics data numbers is larger than 127, you will have to redesign the graphics. This is covered later in this appendix in greater detail than is possible here.

Be sure that no other commands or carriage returns come between the graphics command and its data. See Chapter 9.

If the printer "freezes" in graphics mode, you have sent a different number of data codes from the one you specified in the command.

The printer expects a certain number of pin patterns, determined by n1 and n2. It will wait patiently until the quota is fulfilled. Take extra care with 9-pin graphics mode since it requires two data bytes for each column of graphics.

Width problems

If you are not able to get a full page in width, check whether you have set the margins by switching off and on again. You may need to change the print width with a command like the WIDTH command in Microsoft BASIC. See your computer documentation.

Problems with irregular darkness of printing

Check that the ribbon is seated correctly. It may need replacing if you have been using it for a long time or for a large amount of printing. It may occur in conjunction with the next problem.

Problems with paper feeding

If a self-adhesive label comes off the backing, it may stick behind the platen causing problems with paper feeding and printing. If this happens, take your LX-86 to a qualified service person or your dealer. Do not attempt to remove the label yourself.

Paper-out sensor
If you find that you are not able to deactivate the paper-out sensor with DIP switch 1-5 or <ESC> 8, the problem is due to the interface cable. Some software monitor printer cable pin 12 and will ignore both <ESC> 8 and the setting of DIP switch 1-5. The computer will stop printing until paper is put in the printer. It is possible to have your printer cable modified to take account of this problem. Please consult your dealer.

Computer hangs
You may find that the computer hangs when a particular piece of software is being run and the printer is off-line because you have set it so, or the printer has run out of paper. Some software monitors printer cable pin 11 and will halt because it thinks the printer is busy. It is not possible to modify the cable for this problem although the cable is signalling to the computer that the printer is off-line, because this would result in data being lost by the printer.

SelecType Solutions

If you have found that your software sends a resetting code and wipes out your SelecType settings, one of the following methods should help you find a way around the problem.

Method 1
Use the installation program for your software to remove the initialization code. See your software manual for details.

Method 2
Without using SelecType, give your program the command to print your document. Then, before the printing actually starts, give the command to stop printing. Now use SelecType to select the typestyle you want as in the following example for setting condensed mode:

1) Make sure that both the ON LINE and READY lights are on.
2) Press the ON LINE and FORM FEED buttons at the same time.
3) Press the ON LINE button three times (the code for condensed).
4) Press the FORM FEED button to set condensed.
5) Press the LINE FEED button to exit SelecType.
6) Press the ON LINE button.

Now give your printer the command to resume printing. If your example is now in condensed, you can use this same sequence each time you want to use SelecType. The procedure is not complicated. Once you have practiced it a few times, you will have fingertip control of your printing.

Method 3

Another method that may work with your software is to give the print command with the printer turned OFF. If at this point your screen gives you a message that your printer is off-line and tells you to press a certain key to re-try the printing after the printer is on, you may be able to turn on the printer and use SelecType before you press the key to signal that you want to re-try printing. Try turning on the printer and using SelecType as outlined above. Once you have selected your print function and put the printer back on-line by pressing the ON LINE button once, give your computer system the signal to resume printing.

Method 4

This is a variation of Method 3. Try giving the print command for your program and then pressing the ON LINE button to take the LX-86 off-line before printing actually starts. Then follow the procedure in Method 3.

Cancelling Functions with SelecType

If you want to cancel the modes you have set with SelecType, you can turn your printer off and back on with the power switch on the right side of the printer. This cancels all SelecType settings, returns your LX-86 to its defaults, resets the top of page, and empties the contents of the buffer, including any user-defined characters that you may have put there.

Occasionally you may wish to cancel one or more modes with SelecType instead of resetting the printer with the power switch. To cancel all modes controlled by SelecType, simply enter SelecType mode and then press the FORM FEED button without pressing the ON LINE button. (This is the zero code from Table 2-1.) This is useful when you make a mistake while setting codes and want to start over again, and it does not interfere with top of page, user-defined characters, or other items that are not controlled by SelecType. It will set you in pica mode.

If you do make a mistake while using SelecType, just press the LINE FEED button to turn off SelecType and then turn it on again and press the FORM FEED button before you press the ON LINE button.

In fact, you may prefer to use this method with the FORM FEED button to cancel any previous SelecType setting each time you use SelecType rather than switching off. If you want to be absolutely certain that no previous settings interfere with your use of SelecType, always press the FORM FEED button once immediately after you enter SelecType mode. For this procedure, after you press the ON LINE and FORM FEED buttons to turn on SelecType, press the FORM FEED button once, and then make and set your selection or selections as outlined in Chapter 2.

You can also cancel individual modes with SelecType if you wish. You do this with the same procedure that sets them. When a mode is already set, selecting it again cancels it, as demonstrated in the example below.

Suppose that you have set double-strike and condensed modes and then you decide that you don't want double-strike. You can either cancel all the modes and reset condensed, or you can use the following steps to cancel double-strike and leave condensed.

1) See that the ON LINE and READY lights are on. (Make sure that you do not touch the power switch and cancel all the modes.)
2) Press the ON LINE and FORM FEED buttons to enter SelecType.
3) Press the ON LINE button twice. (This is the code for double-strike.) Notice that the ON LINE light is blinking and that it is on more than it is off. This tells you that the double-strike mode is set.
4) Press the FORM FEED button once. Now the ON LINE light is still blinking, but it is off more than it is on. This tells you that the double-strike mode is not set.
5) Press the LINE FEED button once to leave SelecType mode.
6) Press the ON LINE button to put the printer on-line.

Now you have cancelled double-strike without affecting any other modes.

You may feel that this procedure is too complicated and prefer to cancel all the SelecType settings and then reset the ones you want. Use whichever method you prefer. If you want to cancel modes individually, remember to watch the ON LINE light. It blinks mainly on when a mode is set and mainly off when it is not.

Other software

For some software you may have to consult their manuals or your dealer to find out at what point the printer is reset. You will probably find some stage in the printing process after the resetting where you can use SelecType.

Some of these tests may seem to take too much time and trouble, but you need to do them only once. Then you will know exactly what you need to do each time you use SelecType. After you have done the SelecType procedure two or three times, it will become quick and easy.

Beeper Error Warnings

When the LX-86's beeper sounds, it usually indicates that the printer is out of paper. The beeper can also be sounded by any program that sends the ASCII 7 code and by certain error conditions in the printer itself.

If the printer beeps and stops printing when it is not out of paper, turn the printer off and check to see if the paper is loaded correctly. If the paper is loaded correctly, turn the printer back on and try to print again. If the printer beeps and does not print again, consult your dealer.

Data Dump Mode

The LX-86 has a special feature that makes it easy for experienced printer users to find the causes of problems. Called the data dump mode, it gives a printout of exactly which codes reach the printer.

Turn on this mode by turning on the printer while holding down the FORM FEED and LINE FEED buttons at the same time. The LX-86 will print the words "Data Dump Mode." Then, when you send data to the printer, the LX-86 prints it in a special way. Each line is printed in three parts: a line number (four digits), the hexadecimal codes (up to 16 numbers) of the characters sent, and a guide section (16 characters at the end of each line except the last).

The hexadecimal numbers are the codes received by the printer. The guide section interprets the codes where possible in normal characters. Each character in the guide section corresponds to one of the codes. If the code is for a printable character, that character is printed. If the code is for a non-printable character, such as the <ESC> code or the code for a line feed or carriage return, a dot is printed.

Therefore, if you ran the following BASIC program while your LX-86 was in the data dump mode, you would get the printout shown below it. The printer will print all but the last line and then stop. You will have to press the ON LINE button to make the LX-86 print the last line.

```
10 FOR X=70 TO 73
20 LPRINT CHR$(X): NEXT X
30 LPRINT CHR$(27)"E"
40 LPRINT "Sample text"
50 LPRINT CHR$(27)"@"
```

```
Data Dump Mode
0000 46 0D 0A 47 0D 0A 48 0D 0A 49 0D 0A 1B 45 0D 0A  F..G..H..I...E..
0001 53 61 6D 70 6C 65 20 74 65 78 74 0D 0A 1B 40 0D  Sample text...@.
0002 0A
```

You can consult Appendix A or the Quick Reference Card to see the meaning of the hexadecimal codes. The following explanation of the first line will help you to understand what is happening.

The first code in line 0000 is hex 46, which is the same as decimal 70, the code for the letter "F". The "F" is printed in the first position in the guide section. Then, because there is no semicolon in line 20, MBASIC sends a carriage return and a line feed, hex codes 0D and 0A. Each of these is represented by a dot in the guide section. The program then sends the hex codes 47, 48, and 49, corresponding to decimal 71, 72 and 73 with each followed by a carriage return and line feed.

When the program gets to line 30, it sends <ESC> E and a carriage return and line feed. These are hex codes 1B, 45, 0D, and 0A, which are represented in the guide section by a dot, an "E", and two more dots.

Some computer systems change one or more codes when sending them from BASIC to the printer. The ability of the LX-86 to dump in hexadecimal lets you determine which codes are creating problems for your system.

Use Appendix A to translate any character codes from hexadecimal if the guide part of the line is not sufficiently helpful.

A hex printout of a program shows you exactly what the printer is receiving, regardless of what the computer is sending. The following test program lets you check to see what codes, if any, are problems for your computer system.

```
10 FOR X=0 TO 255
20 LPRINT CHR$(X);
30 NEXT X
```

Put the printer in data dump mode and then RUN the program. Remember to press the ON LINE button to make the LX-86 print the final line. Then compare your printout with the list of hex codes in order in the middle columns of page A-2 in Appendix A. If any are skipped or repeated, you will know that your BASIC language changes some codes before it sends them to the printer.

For example, in the line below, which is the first line of the printout of the test program run on a system that changes hex 09, which is the code for horizontal tabbing, to several 20s, the code for a space. Therefore, you know that if you use this system, you must be careful about sending a decimal 9 (hex 09).

```
0000 00 01 02 03 04 05 06 07 08 20 20 20 20 20 20 20  ........
```

The data dumping capability can help you debug a program quickly. Appendices A to C will help you translate the hex codes to ASCII equivalents.

Coding Solutions

Once you've determined that a code creates problems for your printing, either by trial and error or by using the data dumping capability of the LX-86, you can start overcoming them.

Because each computer system deals with ASCII codes differently, it is impossible to provide solutions for all potential problems in one appendix. The following general approach suggests possible ways to handle them.

There are four common methods. First, you may be able to buy an alternative printer interface card for your system. This is the best solution for 7-bit system problems. See your computer dealer for advice about this.

The second approach is to use commercially available software that is specifically designed to overcome these coding problems. Consult your computer dealer or computer publications to see if a program for your computer system is available.

The third approach consists of avoiding the software that is changing the codes. On most computers you can send each code directly to the printer port. This bypasses the BASIC interpreter and avoids the interface.

Unfortunately, this process is also different for each computer system. Some of the specific computers mentioned may not be yours, but they may serve as models to enable you to know what to do. Consult your computer manual to determine if you can do the same on your system.

A fourth approach is to change the printer driver program in your system. This requires a knowledge of machine language and of the way your computer works. If you don't have this knowledge, your computer dealer may be able to help you or suggest someone who can.

Solutions for Specific Systems

The next subsections illustrate dealing with interface problems on several types of computers.

Applesoft BASIC solutions

Applesoft BASIC does not use PRINT to send data to the screen and LPRINT to send data to the printer as MicroSoft BASIC does. You have to issue the command PR#1 to switch the printer on and PR#0 to switch it off.

If one of the programs in this manual contains an INPUT statement or a PRINT statement, there will be a message that should go to the screen before anything is sent to the printer. In these programs, leave the first lines as they are and after the INPUT and/or PRINT statements, add a line that states PR#1. Then change all the instances of LPRINT to PRINT and put a line that states PR#0 at the end of the program.

Apple II solutions

There are two types of problems that you who own Apple II computers will need to address. The first is that the Apple II is an 8-bit computer, but works mainly with 7 bits. The eighth bit is often set permanently to a 1 (ON). This means that most printer interfaces only handle 7 bits, because of the need to remove the 1 from the eighth bit. The second type of problem is that the interface normally has its own use for ASCII code 9. These problems restrict you in sending graphics data.

Should you need an 8-bit system, the simplest solution is to purchase a new printer interface card from your computer dealer. Such a card is available for the Apple II.

The Apple II uses ASCII CODE 9 to "initialize" the printer. This code and the following character or characters are intercepted by the printer interface card and used to change modes. For example, you can set the column width to 80 and simultaneously divert all output to the printer instead of to the screen by sending the following lines:

```
PR#1
PRINT CHR$(9)"8ØN"
```

The CHR (9)"80N" code directs all subsequent output to the printer, up to 80 characters per row. You can cancel this by typing:

```
PRINT CHR$(9)"I"     or    PR#O
```

The problem is that the LX-86 uses CHR$(9) to activate horizontal tabulation and can also use it in graphics programs. When you send this code, however, your system will interpret it as a printer initialization code and the program will not work properly. In these cases the interface manual will normally tell you how to change the initialization character to another one. If you are using a word processor you should not have much trouble, as the software will normally handle these problems.

With the Apple software such as the "Appleworks" package or anything running under prodos, you may find your printer card will not allow you to print anything to the LX-86. In this case consult your dealer as the ROM on the interface card may need updating.

IBM-PC solutions

There are two problems in using the IBM Personal Computer BASIC to drive a printer. First, the IBM-PC BASIC inserts a carriage-return/line-feed (CR-LF) after each 80 characters you send it. Second, it adds an LF to each CR in an LPRINT statement.

Here is the way to adjust the width when it is the only problem. Tell the computer that the print line is wider than 80 characters with this WIDTH statement:

```
WIDTH "LPT1:", 255
```

The 255 is a special number that prevents the computer system from inserting a CR-LF into the line. Unless, of course, there is one in your program.

The extra line feed—CHR$(10)—that accompanies each carriage return—CHR$(13)—is no problem except when you need to use CHR$(13) in a graphics program. Getting rid of the extra CHR$(10) is rather complicated. First you open the printer as a random file:

```
OPEN "LPT1:" AS #1
```

Although this allows you to send any code to the printer, you can no longer use the LPRINT command. Use a PRINT #1 instead.

```
PRINT #1, "Now I can print anything"
```

If you want to print more than 80 characters per line in a graphics program, you must therefore change your opening statement to include the appropriate WIDTH statement:

```
OPEN "LPT1:" AS #1 : WIDTH #1, 255
```

And for the programs in this manual, don't forget to use PRINT #1 wherever we use LPRINT.

This won't work for those of you who have the original release of the Disk Operating System (DOS 1.0). It can't run a printer like a file. IBM has, however, issued an update; take a disk to your dealer to get your copy.

Another printer problem with DOS 1.0 is that it doesn't send CHR$(7) to the printer; it just rings the computer's bell. This has also been corrected in subsequent versions.

QX-10 multifont CP/M solutions

There are two problems you may experience when using the Multifont CP/M system. Firstly, it is not possible to send control characters in the range 0-31 without first giving the BIT ON command in Multifont BASIC. You may have trouble in sending control characters using software in the CP/M environment, not just BASIC. In this case your dealer will be able to tell you how to patch the program, or give you a short COM file to run before you run the applications program.

When you configure your system you should take the FX-80 option in the CONFIG program. This may cause you problems in some cases because the QX-10 will automatically send a carriage return and line feed after 80 characters. You can extend this to 100 characters by taking the FX-100 option in CONFIG. If you want more, you will have to go back to your dealer to obtain a patch to CP/M. In Multifont BASIC, the WIDTH LPRINT 255 will overcome this problem.

BBC BASIC solutions

The command to send the next character to the printer port is VDU 1. However, you can also switch the printer port on by giving the command VDU 2, then use PRINT and all characters will print both on the screen and the printer. If one of the programs in this manual contains an INPUT statement or a PRINT statement, there will be a message that should go to the screen before anything is sent to the printer. In these programs, leave the first lines as they are and after the INPUT and/or PRINT statements, add a line that states VDU 2.

Then change all the instances of LPRINT to PRINT and put a line that states VDU 3 at the end of the program. This switches all output to screen only. When using the VDU 1 command to send codes to the LX-86, remember a "1" has to be used after EACH character you wish to output. Thus the command to set enlarged characters until switched off (<ESC> W1) requires the sequence:

VDU 1,27,1,87,1,1

Appendix G
Printer Maintenance

Always

Always keep your printer in a safe and clean location. Keep it away from:

Dust and grease

Heaters and furnaces. Safe temperature range is 5°C (41°F) to 35°C (95°F)

Now and Then

Clean particles and dust from the printer every so often with a soft cloth or brush. Use a mild cleanser for the outside framework and, after removing the ribbon cassette, denatured alcohol for the inside.

See your Epson dealer for replacement ribbon cassettes.

Default LPI = 6

Appendix H
Technical Specifications

Printing

Printing method ..... Impact dot matrix
Printing speed ..... 120 characters per second
Paper feed speed ..... Approximately 150 ms/line (at 1/6 inch/line)
Approximately 100 ms/line (during continuous line feed)
Printing direction ..... Bidirectional, logic seeking
Unidirectional (left to right) in graphics mode

Character size

Mode	Width inches	Height inches
Pica	.083 in	.122 in
Pica double-width	.166 in	.122 in
Elite	.059 in	.122 in
Elite double-width	.118 in	.122 in
Condensed	.041 in	.122 in
Condensed double-width	.083 in	.122 in
Super/Subscript		.063 in

Line spacing ..... Default is 1/6 inch. Programmable in increments of 1/72 inch and 1/216 inch

Characters per line:

	Maximum characters per line
Pica	80
Pica double-width	40
Elite	96
Elite double-width	48
Condensed	132*
Condensed double-width	66*
Condensed elite	160

*137 if right margin is changed.
*68 if right margin is changed.

Paper

	Paper width	Paper feed
Pin-feed	4″ to 10″	Tractor feed with optional tractor
Single sheet	up to 8.5″	Friction feed
Number of copies	One original plus one copy; total thickness not to exceed 0.005″	

Printer

Ribbon	Cassette ribbon, black
MCBF	3 million lines (excluding print-head life)
Print head life	100 million characters
Power	120 VAC ± 10% (US models) 220/240 VAC ± 10% (European models)
Power usage	70 volt-amperes maximum
Frequency	49.5 to 60.5 Hz

Dimensions and Weight

Height	3.3 in
Width	16.6 in
Depth (without paper separator)	12.4 in
Weight	11.5 lbs

Environment

Temperature	Operating 5°C to 35°C (41°F to 95°F) Storage −30°C to 65°C (−22°F to 149°F)
Humidity	Operating 10% to 80% (no condensation) Storage 5% to 85% (no condensation)
Shock	Operating 1 G (less than 1 millisecond) Storage 2 G (less than 1 millisecond)
Vibration	Operating 0.25 G, 55Hz (maximum) Storage 0.50 G, 55Hz (maximum)
Insulation resistance	10 megaohms between AC power line and chassis
Dielectric strength	No trouble when 1 kilovolt (R.M.S.) 50 or 60 Hz is applied for more than 1 minute between AC power line and chassis

Interface

Interface	Centronics compatible, 8-bit parallel
Synchronization	By externally supplied $\overline{\text{STROBE}}$ pulses
Handshaking	By $\overline{\text{ACKNLG}}$ or BUSY signals
Logic level	Input data and all interface control signals are compatible with TTL levels

Appendix I
The Parallel Interface

The LX-86 printer uses a parallel interface to communicate with the computer; this appendix describes it.

Connector pin assignments and a description of respective interface signals are shown in Table I-1.

Table I-1. Pins and signals

Signal Pin	Return Pin	Signal	Direction	Description
1	19	$\overline{\text{STROBE}}$	IN	$\overline{\text{STROBE}}$ pulse to read data in. Pulse width must be more than 0.5 microseconds at the receiving terminal.
2 3 4 5 6 7 8 9	20 21 22 23 24 25 26 27	DATA1 DATA2 DATA3 DATA4 DATA5 DATA6 DATA7 DATA8	IN IN IN IN IN IN IN IN	These signal represent information of the 1st to 8th bits of parallel data, respectively. Each signal is at HIGH level when data is logical 1 and LOW when it is logical 0.
10	28	$\overline{\text{ACKNLG}}$	OUT	Approximately 12-microsecond pulse. LOW indicates that data has been received and that the printer is ready to accept more data.
11	29	BUSY	OUT	A HIGH signal indicates that the printer cannot receive data. The signal goes HIGH in the following cases: 1) During data entry. 2) During printing. 3) When off-line. 4) During printer-error state.
12	30	PE	OUT	A HIGH signal indicates that the printer is out of paper.

Table I-1, continued

Signal Pin	Return Pin	Signal	Direction	Description
13	—	—	—	Pulled up to +5 volts through 3.3K ohm resistance.
14	—	$\overline{\text{AUTO FEED XT}}$	IN	When this signal is LOW, the paper is automatically fed 1 line after printing. (The signal level can be fixed to this by setting DIP switch 2-3 to ON.)
15	—	NC	—	Unused.
16	—	0V	—	Logic ground level.
17	—	CHASSIS GND	—	Printer's chassis ground, which is isolated from the logic ground.
18	—	NC	—	Unused.
19–30	—	GND	—	Twisted-pair return signal ground level.
31	—	$\overline{\text{INIT}}$	IN	When this level becomes LOW, the printer controller is reset to its power-up state and the print buffer is cleared. This level is usually HIGH; its pulse width must be more than 50 microseconds at the receiving terminal.
32	—	$\overline{\text{ERROR}}$	OUT	This level becomes LOW when the printer is in: 1) Paper-end state. 2) Off-line. 3) Error state.
33	—	GND	—	Same as for pins 19–30.
34	—	NC	—	Unused.
35	—	—	—	Pulled up to +5V through 3.3K ohm resistance.
36	—	$\overline{\text{SLCT IN}}$	IN	Data entry to the printer is possible only when this level is LOW; DIP switch 2-2 is set for this at the factory.

Notes:

1. The column heading "Direction" refers to the direction of signal flow as viewed from the printer.
2. "Return" denotes the twisted-pair return, to be connected at signal ground level. For the interface wiring, be sure to use a twisted-pair cable for each signal and to complete the connection on the return side. To prevent noise, these cables should be shielded and connected to the chassis of the host computer or the printer.
3. All interface conditions are based on TTL level. Both the rise and the fall times of each signal must be less than 0.2 microsecond.

4. Data transfer must be carried out by observing the $\overline{\text{ACKNLG}}$ or BUSY signal. (Data transfer to this printer can be carried out only after receipt of the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is LOW.)
5. Under normal conditions, printer cable pins 11, 12, and 32 are activated when the paper-end condition is detected. The <ESC> 8 code disables pins 11 and 32, but not pin 12. Those computers that monitor pin 12 halt printing when the paper is out, making <ESC> 8 ineffective.

Data Transfer Sequence

Interface timing

Figure I-1 shows the timing for the parallel interface.

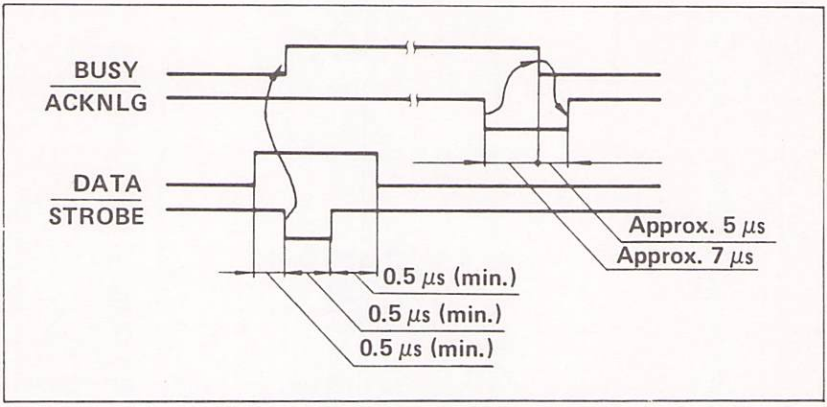


Figure I-1. Parallel interface timing

Signal relationships

Table I-2 shows the way data entry is handled in the on-line and off-line states by showing the relationships between seven signal sets.

Table I-2. Signal interrelations

On-Line	$\overline{\text{SLCT IN}}$	ERROR	BUSY	$\overline{\text{ACKNLG}}$	DATA ENTRY
OFF	HIGH/LOW	LOW	HIGH	Not generated	Disabled
ON	HIGH	HIGH	LOW/HIGH	Generated after data entry	Enabled*
ON	LOW	HIGH	Same	Same	Enabled (normal entry)

*When $\overline{\text{SLCT IN}}$ is at high level, data entry is enabled, but the input data will be disregarded until $\overline{\text{SLCT IN}}$ is at low level.

Note: $\overline{\text{ERROR}}$ status is assumed to rest only in off-line state, and the $\overline{\text{ERROR}}$ status does not always mean $\overline{\text{SLCT IN}}$.

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W

WIDTH statements 37, F-2, F-12
Width of characters H-1
Word processors use with 14, 31, 55

Z

Zero slashed D-2

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Quick Reference Card

EPSON

Standard and Character/Graphic Sets by Code

Configuration

<ESC> @	Initialize Printer
<ESC> s	Select Half Speed Mode
<ESC> <	Set Unidirectional Mode (one line)
<ESC> U (n)	Set Unidirectional Mode
DC3	Deselect Printer
DC1	Select Printer
<ESC> 8	Disable Paper-Out Sensor
<ESC> 9	Enable Paper-Out Sensor
<ESC> <EM> (n)	Cut Sheet Feeder Control

Paper Line Feed Commands

LF	Line Feed
<ESC> 0	Set 1/8 Inch Line Spacing
<ESC> 1	Set 7/72 Inch Line Spacing
<ESC> 2	Set 1/6 Inch Line Spacing
<ESC> 3 (n)	Set n/216 Inch Line Spacing
<ESC> J (n)	n/216 Inch Line Feed for One Line
<ESC> A (n)	Set n/72 Inch Line Spacing

Paper Form Feed Commands

FF	Form Feed
<ESC> C (n)	Set Page Length in Lines
<ESC> C <NUL> (n)	Set Page Length in Inches

Vertical Formatting Commands

<ESC> N (n)	Set Skip Over Perforation
<ESC> O	Cancel Skip Over Perforation
<ESC> B (n1) (n2) (0)	Set Vertical Tabs
<ESC> b (c) (n1) (n2) (0)	Set Vertical Tabs in Channels
<ESC> / (c)	Select Vertical Tab Channel
VT	Tab Vertically
<ESC> e 1 (s)	Set Vertical Tab Increments
<ESC> f 1 (s)	Vertical Skip

Horizontal Formatting Commands

HT	Tab Horizontally
<ESC> Q (n)	Set Right Margin
<ESC> l (n)	Set Left Margin
<ESC> D (n1) (n2) (0)	Set Horizontal Tabs
<ESC> e 0 (s)	Set Horizontal Tab Increments
<ESC> f 0 (s)	Horizontal Skip
<ESC> a (n)	Select Justification Mode

Miscellaneous character codes

CR	Carriage Return
BEL	Bell Character

BS	Backspace
DEL	Delete Character
CAN	Cancel Line

General Print Style Selection

<ESC> ! (n)	Select Master Style
<ESC> x (n)	Select Print Mode
<ESC> M	Select Elite Pitch
<ESC> P	Select Pica Pitch

Print Size Commands

SI	Set Condensed Characters
<ESC> SI	Set Condensed Characters
DC2	Cancel Condensed Print
SO	Set Double-Width Characters (one line)
<ESC> SO	Set Double-Width Characters (one line)
DC4	Cancel Double-Width Characters (one line)
<ESC> W (n)	Select Double-Width Characters
<ESC> E	Set Emphasized Print
<ESC> F	Cancel Emphasized Print
<ESC> G	Set Double-Strike Mode
<ESC> H	Cancel Double-Strike Mode
<ESC> S (n)	Set Superscript/Subscript
<ESC> T	Cancel Superscript/Subscript
<ESC> − (n)	Select Underlining

Alternative Character Sets

<ESC> R (n)	Select International Character Set
<ESC> 4	Set Italic Characters
<ESC> 5	Cancel Italic Characters
<ESC> &	Define User-Defined Characters
<ESC> :	Copy ROM Into User-Defined Characters
<ESC> %	Select User-Defined Set
<ESC> m (n)	Select Special Graphic Character
<ESC> t (n)	Select Character Set
<ESC> 6	Cancel Upper Control Codes
<ESC> 7	Enable Upper Control Codes

Graphics (Bit Image) Commands

<ESC> K	Set Single Density Graphics Mode
<ESC> L	Set Double Density Graphics Mode
<ESC> Y	Set High Speed Double Density Graphics Mode
<ESC> Z	Set Quadruple Density Graphics Mode
<ESC> *	Select Graphics Mode
<ESC> ?	Reassign Graphics Mode
<ESC> ^	Select 9-Pin Graphics Mode

SelecType Modes

Mode	Typestyle	
	Draft	NLQ
0	Pica	Pica
1	Emphasized	Emphasized
2	Double-strike	—
3	Condensed	—
4	Elite	—

DIP Switch Setting

Switch 1

No.	UP (ON)	Functions	DOWN (OFF)
1-8	See Below	International character set	
1-7	See Below	International character set	
1-6	See Below	International character set	
1-5	Inactive	Paper-out sensor	Active
1-4	12-inch	Form length	11-inch
1-3	Active	Cut-sheet feeder	Inactive
1-2	Graphics	Character table	Standard
1-1	Condensed	Print width	Pica

Switch 2

No.	UP (ON)	Functions	DOWN (OFF)
2-4	Silent	Beeper	Sounds
2-3	CR +LF	Automatic line feed	CR only
2-2	Active	Printer-select	Standard
2-1	Ø	Slashed zero	0

Note: The shaded boxes show the factory settings.

International Characters

Country	Switch 1-6	Switch 1-7	Switch 1-8
USA	Up (On)	Up (On)	Up (On)
France	Up (On)	Up (On)	Down (Off)
Germany	Up (On)	Down (Off)	Up (On)
United Kingdom	Up (On)	Down (Off)	Down (Off)
Denmark	Down (Off)	Up (On)	Up (On)
Sweden	Down (Off)	Up (On)	Down (Off)
Italy	Down (Off)	Down (Off)	Up (On)
Spain	Down (Off)	Down (Off)	Down (Off)

Control Codes by Function

Dec	Hex	Standard	Graphic	Dec	Hex	Standard	Graphic	Dec	Hex	Standard	Graphic
0	00	NUL	NUL	43	2B	+	+	86	56	V	V
1	01			44	2C	,	,	87	57	W	W
2	02			45	2D	-	-	88	58	X	X
3	03			46	2E	.	.	89	59	Y	Y
4	04			47	2F	/	/	90	5A	Z	Z
5	05			48	30	0	0	91	5B	[	[
6	06			49	31	1	1	92	5C	\	\
7	07	BEL	BEL	50	32	2	2	93	5D	]	]
8	08	BS	BS	51	33	3	3	94	5E	^	^
9	09	HT	HT	52	34	4	4	95	5F		
10	0A	LF	LF	53	35	5	5	96	60	`	`
11	0B	VT	VT	54	36	6	6	97	61	a	a
12	0C	FF	FF	55	37	7	7	98	62	b	b
13	0D	CR	CR	56	38	8	8	99	63	c	c
14	0E	SO	SO	57	39	9	9	100	64	d	d
15	0F	SI	SI	58	3A	:	:	101	65	e	e
16	10			59	3B	;	;	102	66	f	f
17	11	DC1	DC1	60	3C	<	<	103	67	g	g
18	12	DC2	DC2	61	3D	=	=	104	68	h	h
19	13	DC3	DC3	62	3E	>	>	105	69	i	i
20	14	DC4	DC4	63	3F	?	?	106	6A	j	j
21	15			64	40	@	@	107	6B	k	k
22	16			65	41	A	A	108	6C	l	l
23	17			66	42	B	B	109	6D	m	m
24	18	CAN	CAN	67	43	C	C	110	6E	n	n
25	19	EM	EM	68	44	D	D	111	6F	o	o
26	1A			69	45	E	E	112	70	p	p
27	1B	ESC	ESC	70	46	F	F	113	71	q	q
28	1C			71	47	G	G	114	72	r	r
29	1D			72	48	H	H	115	73	s	s
30	1E			73	49	I	I	116	74	t	t
31	1F			74	4A	J	J	117	75	u	u
32	20	SP	SP	75	4B	K	K	118	76	v	v
33	21	!	!	76	4C	L	L	119	77	w	w
34	22	"	"	77	4D	M	M	120	78	x	x
35	23	#	#	78	4E	N	N	121	79	y	y
36	24	$	$	79	4F	O	O	122	7A	z	z
37	25	%	%	80	50	P	P	123	7B	{	{
38	26	&	&	81	51	Q	Q	124	7C	|	|
39	27	'	'	82	52	R	R	125	7D	}	}
40	28	(	(	83	53	S	S	126	7E	~	~
41	29	)	)	84	54	T	T	127	7F	DEL	DEL
42	2A	*	*	85	55	U	U				

Dec	Hex	Standard	Graphic
128	80		Ç
129	81		ü
130	82		é
131	83		â
132	84		ä
133	85		à
134	86		å
135	87	BEL	ç
136	88	BS	ê
137	89	HT	ë
138	8A	LF	è
139	8B	VT	ï
140	8C	FF	î
141	8D	CR	ì
142	8E	SO	Ä
143	8F	SI	Å
144	90		É
145	91	DC1	æ
146	92	DC2	Æ
147	93	DC3	ô
148	94	DC4	ö
149	95		ò
150	96		û
151	97		ù
152	98	CAN	ÿ
153	99	EM	Ö
154	9A		Ü
155	9B	ESC	¢
156	9C		£
157	9D		¥
158	9E		₧
159	9F		ƒ
160	A0	SP	á
161	A1	!	í
162	A2	"	ó
163	A3	#	ú
164	A4	$	ñ
165	A5	%	Ñ
166	A6	&	ª
167	A7	'	º
168	A8	(	¿
169	A9	)	⌐

Dec	Hex	Standard	Graphic
170	AA	*	¬
171	AB	+	½
172	BC	,	¼
173	AD	-	¡
174	AE	.	«
175	AF	/	»
176	B0	0	▒
177	B1	1	▒
178	B2	2	▒
179	B3	3	│
180	B4	4	┤
181	B5	5	┤
182	B6	6	┤
183	B7	7	┐
184	B8	8	┐
185	B9	9	┤
186	BA	:	┤
187	BB	;	┐
188	BC	<	┘
189	BD	=	┘
190	BE	>	┐
191	BF	?	└
192	C0	@	┴
193	C1	A	┬
194	C2	B	├
195	C3	C	─
196	C4	D	┼
197	C5	E	├
198	C6	F	└
199	C7	G	┌
200	C8	H	┐
201	C9	I	┌
202	CA	J	┬
203	CB	K	┬
204	CC	L	├
205	CD	M	─
206	CE	N	┼
207	CF	O	┴
208	D0	P	┴
209	D1	Q	┬
210	D2	R	┬
211	D3	S	└
212	D4	T	└

Dec	Hex	Standard	Graphic
213	D5	U	┌
214	D6	V	┼
215	D7	W	┼
216	D8	X	┘
217	D9	Y	┘
218	DA	Z	┌
219	DB	[	▓
220	DC	\	▄
221	DD	]	▌
222	DE	^	▐
223	DF		▀
224	E0	`	α
225	E1	a	ß
226	E2	b	Γ
227	E3	c	π
228	E4	d	Σ
229	E5	e	σ
230	E6	f	µ
231	E7	g	τ
232	E8	h	Φ
233	E9	i	Θ
234	EA	j	Ω
235	EB	k	δ
236	EC	l	∞
237	ED	m	Ø
238	EE	n	∈
239	EF	o	∩
240	F0	p	≡
241	F1	q	±
242	F2	r	≥
243	F3	s	≤
244	F4	t	⌠
245	F5	u	⌡
246	F6	v	÷
247	F7	w	≈
248	F8	x	°
249	F9	y	∙
250	FA	z	·
251	FB	{	√
252	FC	/	n
253	FD	}	2
254	FE	~	■
255	FF	DEL	SP

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Line spacing to (24
App C pg 7
(C7).

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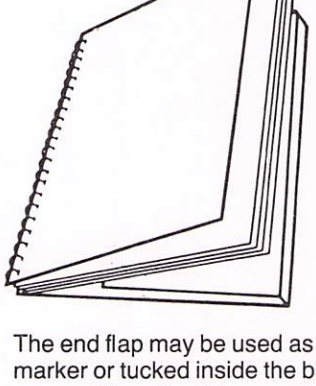

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